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Extracts from Chordal's Letters.

TOMBSTONES FOR MECHANICAL PURPOSES—ROUNDING OFF AND FINISHING CORNERS—ACCIDENTS TO INVENTORS FROM THEIR OWN CONTRIVANCES—CHANGING MATERIAL IN MAKING REPAIRS.

Mr. Editor:

* * * * White & Crabson had a punching and shearing machine in their machine shop. It was a solid looking customer with a good bite and driven by about a three-inch belt. It stood on a solid square pedestal measuring about two feet each way. I had often seen this pedestal but never knew just what it was made of. It looked as though it might be solid grease. A short time ago the firm, having outgrown their old shop, moved into new, roomy and well-lighted quarters. Everything in this new shop was plainly visible and I beheld the old punch resplendent in a bran new coat of cleanliness. The pedestal had a queer look about it. It was not made of lard oil. I examined it closely. It was marble. I examined it more closely and read "Sacred to the memory of John Wilkins. Born 1816, died 1835." That settled it. Some sacrilegious vandal of an iron puncher had robbed the dead of a monument to take the tremble out of this punch.

* * * * Give the average lathe hand a cylinder head to finish. He will turn off the edge, face the job up and go at it with emery sticks. He will never give a thought to the corner. If he has to polish at it for an hour or two to get it to look decent, the corners will be incidentally dulled or rounded off. If the tool work was so nicely done that a few minutes rubbing puts the polish on, the corners will be left so sharp that it will draw blood before it leaves the shop and will become dented and marred by a single month of ordinary existence. A studied system of finish involves, or should involve, the total suppression of all keen corners, whether finished, or rough or formed by the juncture of a finished surface with a rough one. I saw a short time ago a pillow-block cap whose flat upper surface was splendidly finished. But it was bounded all around by a corner as abrupt, ragged, rough, ugly and unpardonable as a conspiracy between a molder and short-sighted finisher could hope to make it. Even the man who had planed this thing, had allowed his tool to spawl off the iron at the end of the cut, thus causing one corner to be especially unsightly. The job had not even the merit of uniform ugliness.

The chap who finished the surface understood thoroughly how to put a tip top finished surface on cast iron, but in spite of this, I should call him a miserable bungler worth 25 cents a day less than a man with judgment enough to do his work fairly throughout. No foreman is to be excused for passing such work.

A respectable planer hand will always guard against a crumbled corner by a judicious use of chisel and file, used while the planer is running.

A manager of taste will always insist on corners formed by black and bright surfaces being freely rounded or delicately beveled. An extra high finish whipped on to this corner will add immensely to the tidiness and beauty of the job.

If both surfaces are finished, the corner should be dulled and highly polished, whether the work be lathework or square work.

* * * * Aside from matters of beauty and taste, the sharp corner is always an abomination. The last cut in a steam engine cylinder should be to slightly chamfer the inner corners formed by the face and the counterbore. If this is not done, the chap who fits the heads will have to hog the corner out with a half-round file. Some cylinder heads are made with a groove to clear this sharp corner, but this does not interfere with the utility of the chamfer in preventing future danger to the ground seat. If the chamfer shows a thirty-second face, it is plenty for the purpose.

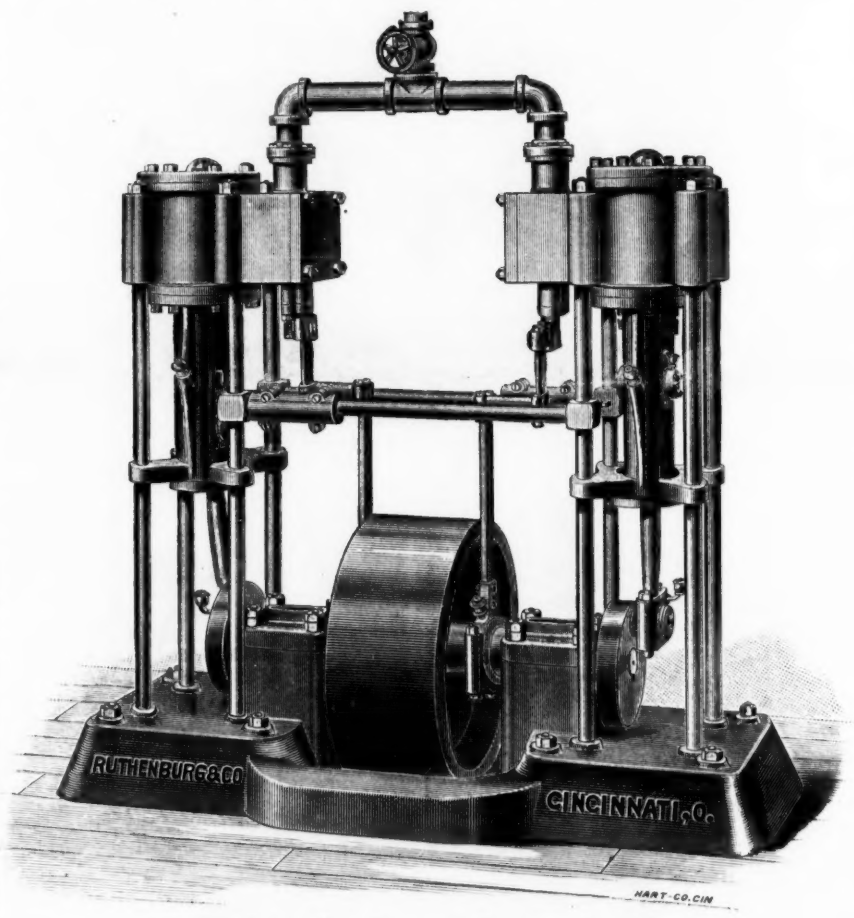
* * * * Modern-studied design of finish is characterized by boldly-rounded external corners, and fillets at all internal corners giving a contour formed by blended straights and arcs. This style of finish looks cheap and common to some people when compared with the more gorgeous array of architectural mouldings, with sharply defined members; but the money cost is far greater. Any lathesman who has had occasion to put one of these plane fillets in the corner formed where a hub joins a web, as in an ordinary polished gear wheel, knows how prone the round nose tool is to go a trifle too deeply into the web, producing a break in the purity of the contour which becomes more objectionable the more it is looked at. The only remedy is to reface the web, and if accurate dimensions are to be adhered to, extraordinary skill and and care is required in the production of passable work. Any two-year-old boy can make splendid inside corners, if composed of ogees and gees, which are entirely independent of the large surface they are intended to ornament.

* * * * This pure continuosity of line has functions other than that of beauty when applied to rough castings. Where a pulley arm joins the rim, every angle is an element of weakness and danger. This is well understood, but we daily see pulleys in which the blending of lines is so illy contrived that we wish the designer had not known of the virtues he seemed to reach for. Last week I saw a magnificently-proportioned fly wheel which, on near inspection, exhibited splendid arms—club footed at both ends where they joined the rim and hub. Either the designer or the moulder had got fearfully rattled when approaching the connecting points

* * * * As a matter of taste I protest against external corners too freely rounded and suggest a comparison of such work with corners rounded with comparative delicacy. As taste only is involved, this suggestion can be taken as not being in conflict with established principles of cornering. I make no reference to internal corners.

* * * * A few days ago I was introduced to Mr. John Watkins; we shook hands and his hand felt queer, I looked at it and it looked queer; it didn't have fingers enough. In conversation Mr. Watkins stated, that in his long experience with stave machines he had always noticed that green workmen never got hurt by them. The older workmen became over confident and careless and some day, sooner or later, have their experience.

If green hands are kept on dangerous machines no one will be hurt. Stave machines decline green fruit.



HIGH SPEED TWO-CYLINDER ENGINE.—See page 2.

Mr. Watkins stated that he had expended much thought, money, and a few fingers in the attempt to make these machines harmless, even to those who are perfectly familiar with them.

* * * * Many a man has lost more than his fingers in his own contrivances. There is more than one unsinkable, experimental vessel at the bottom of the bays with the skeleton of an inventor aboard. The mythological Dædalus, famous as a blacksmith, credited with the invention of the ax, the saw, the plumb-bob, the auger, masts and yards for ships, and glue, made a flying machine out of his son, some wax, and feathers. The boy steered too close to the sun; the wax melted and he tumbled into the sea. The only lasting honor attached to the exploit was in having the sea named for the boy after he was drowned in it.

The precipitated brains brought into the asylums by perpetual motion would in fair suspension add much to the motive forces of the world.

* * * * Thomas Whitwell was a noted iron master in Stockton-on-Tees. He did much to advance the art of pig-iron making. He invented the celebrated hot-blast stove which bears his name, for heating the air fed to blast furnaces. He turned his attention to gas producers for gasifying fuel for iron-makers purposes. Gas producers are masonry structures with flues, and vaults, and chambers, and up-takes and down-comers, and what not.

Thomas Whitwell had friends at his works, and he was exhibiting the strange lower regions of his gas producer. Peep doors were opened and darker interiors examined. Air got to the gas and heat got to the combination. There was no time for the escape of Mr. Whitwell.

* * * * Mr. Vallandigham, a noted criminal lawyer, was called upon to defend Tom McGhehan, charged with murder. The case called for invention. The defence finally settled on the theory that the victim shot himself. The position of the wound was such as to indicate that it could not be self-inflicted by any man not a professional trapeze performer. Mr. Vallandigham, in explaining the invention, attempted an innocent demonstration with a pistol. The perfect practicability of the theory, as demonstrated, resulted in Mr. Vallandigham's death.

* * * * Years ago Webster Wagner saw that railroad traveling might be invented into a pleasant luxury, as well as a commonplace necessity. He invented drawing room and sleeping cars. He added to the comfort of the public, and the public in return made him comfortable.

Only a few short months ago Mr. Wagner, in one of his own cars and within a stone's throw of New York, met with his death under circumstances the more horrible in the contemplation, owing to the immediate surroundings.

* * * * In one of my late letters, I made mention of a general disposition to make a change in the material when repairing something which has lately given out. The only fault I had to find with the practice was the fact that the old material was too apt to be snubbed and its merits left unconsidered, because of its present failure, notwithstanding the fact that it may have

been years and years in wearing out to the failing point.

Some of these worn-out things assert their pre-eminent value before the memory of their virtues has a chance to fade. After years of good service, a cast-iron packing ring will play out, after the manner of all moving things, and once in a while it occurs to some smart Alec to make the new ring of some better material, such as wrought iron or steel. He is not very apt to forget the virtues of the old ring before he is reminded of them by the bad behavior of the new one.

Oftentimes, a break is blamed upon the character of the material when in fact it may have been due to an extraordinary accidental strain, which any material would have yielded to, and for which the actual breakage formed a very happy sort of a safety valve; whereby more vital parts were saved from damage.

* * * * Some time ago one of the best known master mechanics in the world called my attention to the construction of rocker arms for locomotives. As near as I can remember his language it was as follows: "Most men make these rocker arms of wrought iron, and strong. I make mine, as you see, of cast iron, and strong. Their's will do all the work which it is the duty of rocker arms to do and with a safety factor to spare. Mine will do all the work which it is the duty of a rocker arm to do and with the same safety factor to spare. For the purposes of a rocker arm mine is as good as theirs, and theirs is as good as mine; and the only question is whether they are, or are not, putting into one of their rocker arms sufficient money to pay for two rocker arms of equal actual value. When the smashing time comes their's bends and mine breaks. I can repair mine by making a new one, at a price often not exceeding the cost of straightening their's, which gives me a bran new rocker arm and them an old one, half way on towards its death. The bending quality of their rocker arm in the smash was productive of much damage to adjacent parts, such as valve stems, rocker boxes, links, eccentric rods, &c. My broken rocker arm became my safety valve, and takes a new value in my experience each time I see one stand between a smash and further damage."

* * * * Material can often be changed to great advantage while repairs are being made.

The doctor bought himself a fancy pair of coal tongs for use in the parlor. They were festive looking, well designed for the purpose, and supposed to be of malleable iron. In a short time one leg got broken and the machine was repaired by replacing this broken leg with a wrought iron one. After a while the other fancy leg broke and he replaced that one with a wrought iron leg and then he had a good pair of coal tongs.

* * * * *

Very respectfully,

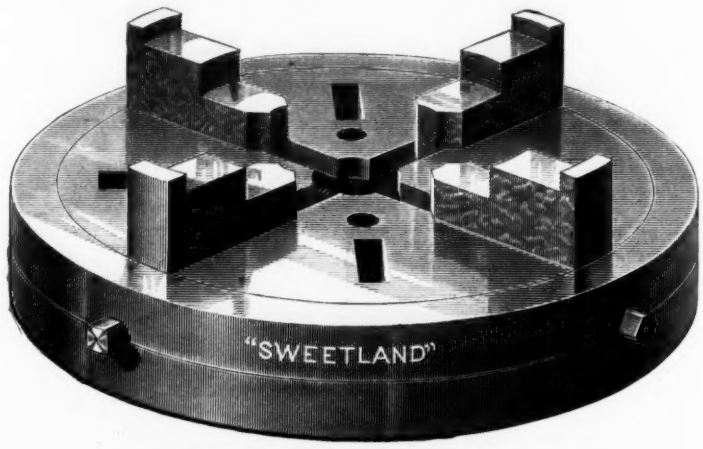
CHORDAL.

Improvements in Lathe Chucks.

By the aid of the accompanying engravings certain improvements in lathe chucks may be observed. In the style of chuck here shown, one, two, or all of the jaws may be operated by the rack, and may be so operated when set in any position upon the face plate.

This feature is specially valuable in chucking eccentric work, as illustrated. For instance, a number of pieces of irregular work, like eccentrics, are to be chucked, drilled and bored. One of these pieces is set true by using one or more of the jaws independently, and, after the work has been satisfactorily adjusted, the rack is thrown into gear, with the jaw or jaws so that any number of pieces may be quickly chucked without special adjustment, in the same way as if they were of a concentric form, and the hole to be bored in the center. Very few castings are made exactly round, but often have a lump upon one side, and to set such castings to run right in a universal chuck would render it necessary to "shin up" with pieces of sheet metal. With this chuck it is only necessary to follow the directions already given for boring and turning eccentrics. On some kinds of work it is an advantage to have part of the jaws moved by the rack held stationary while the other jaws are operated independently. To do this all the workman has to do is to slip back one of the small screws attached to the cam block, which is located directly behind the pinion; this allows the rack to drop out of gear. The small disc springs exert only sufficient pressure to prevent the cam blocks from moving by their own weight, as they always bear upon flat surfaces, and no strain, however great, upon the jaws can slide them in or out of gear. The shifting mechanism is, therefore, easily operated and positive. After using the jaws upon irregular work, they may be quickly adjusted independently to a fine line, shown upon the face, and the rack thrown into gear with all the jaws, which makes a true universal chuck. To clean the screws and jaws from brass chips, which are about the worst evil a lathe hand has to contend with, the rack should be thrown out of gear with the pinions, and each of the jaws removed through the center hole of the face.

The rack is enclosed within a tight case, so that no chips, however small, can possibly reach it, while all the other parts can be removed and cleaned without taking the chuck apart or removing it from the lathe spindle. By the improved form of jaws, the nuts being placed at the inner ends, the strain is brought more directly upon the work, and the leverage exerted to tip the jaws or spring them away from the face is greatly reduced. By removing the greater portion of the sliding friction of the jaws, a much greater grip upon the work is secured, with less strain upon the various parts of the chuck. This is an important feature in the accuracy and durability of the chuck. The chuck illustrated is made as thin as can consistently be done, in order to bring the work as near the spindle journal as possible, to prevent the work from chattering, and insure truer and better work. If by wear the jaws get out of truth, they can be quickly adjusted. In the smaller sizes, a V groove is cut in the jaws to better hold the work, while the larger sizes are grooved in the usual way. This chuck has slots for inserting bolts when necessary, and is held to the spindle in the usual way. The special claims for this chuck are that of having an independent cam attached to a stud placed under each of the pinions by which the annular gear may be thrown in or out of mesh with a part of these pinions, while the others remain in mesh. These features are peculiar to this chuck. It is made by Sweetland & Co., New Haven, Conn., and the original style of it was illustrated and described in the AMERICAN MACHINIST, August 23, 1879.

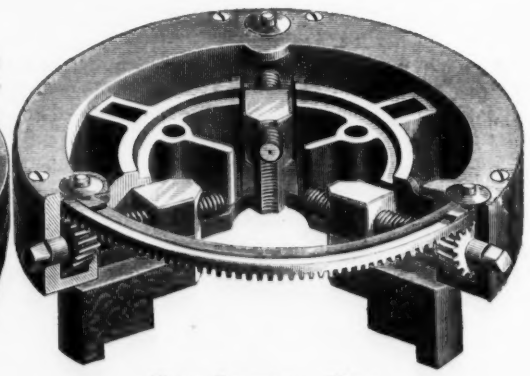


FACE VIEW OF 24 INCH CHUCK.

ECCENTRIC OR IRREGULAR CHUCK WORK.

TRANSPARENT BACK VIEW OF 24 INCH CHUCK.

FRONT SECTIONAL VIEW.



BACK SECTIONAL VIEW.

High-Speed Two-Cylinder Engine.

We illustrate on page 1, a two-cylinder engine built by Marcus Ruthenburg & Co., Cincinnati, Ohio, and designed for a piston speed of 1,000 feet per minute.

In this engine the cylinders are separated by distance rods of steel, which pass up through bearings extending the entire length of the cylinder to hold the several parts rigidly as if in one piece.

The connecting rod is six cranks long, the crank pin end being of the marine type, with a turned joint which it is claimed is superior to a planed joint, in that it relieves the bolts of any except a tensile strain. At the cross head end the pin is made fast in the rod end, the two ends projecting and turning in bearings in the cross head which are adjusted by means of three small keys in connection with a steel bushing split on one side.

This adjustment does not change the length of the rod. Discs are used into which the crank pins are forced and riveted, but contrary to the usual practice the discs are not counterbalanced.

The main journals are lined with hardened tin, and have a length equal to four diameters. Automatic oiling is provided when essential, as in electric lighting, &c.

The engine herewith illustrated has cylinders 7″x7″, with a band fly wheel, 24″ diameter and 12′ face. Those engines are built in sizes from 5″ to 16″ diameter and stroke.

The petition to Congress for the creation of a new Board to test iron, steel, and structural materials on the Government testing machine at the Watertown Arsenal, is being circulated and signed by parties in almost every industrial pursuit. The prospects are that the bill will pass without serious opposition if it can be reached before adjournment. The importance of such a commission to the manufacturing and building interests of the country would seem to warrant the giving of a preference to this bill over some few hundreds of other bills, about which no special anxiety is felt by any considerable portion of the people.

The city of Geneva, Switzerland, furnishes water to manufacturers at one-half the regular rates; the price for use in small water motors being about seven cents per horse power per hour.

The Loss of Power in Line Shafts.

BY A. F. NAGLE, M. E.

A PAPER READ BEFORE THE NEW ENGLAND COTTON MANUFACTURERS' ASSOCIATION.

It is my purpose to inquire into the conditions of loss of power in line shafts due to different speeds, and yet doing the same useful work in each case. It is, therefore, assumed that the machinery to be driven is located, and that the question is, What shall be the speed of the line shaft?

The pulley on the machine and its revolutions being fixed, we obtain the best belt adhesion from the same size pulley on line shaft, and its consequent same number of revolutions; but it is not an uncommon practice to make the pulley on line shaft one-half or one-third that size, and consequent increased revolutions of line shaft. Is this change accompanied by a gain or loss of power?

The loss of power in line shafts arises from friction due to its own weight, the weight of the pulleys, the belt tension, and some minor causes which I will neglect.

1. I will demonstrate that the loss of power due to the weight of the shaft is independent of the speed; that the smaller shaft, running fast, absorbs exactly as much power as the larger, running slow, for equal work performed and shafts proportioned to that work. The accepted formula for the diameter of shafts, is:

$$D = \sqrt[3]{\frac{\text{H. P.} \times \text{constant}}{\text{Rev.}}}$$

As this case is one of comparison of speeds only, we can drop the constants out of the formula, and say that D varies, as

$$\sqrt[3]{\frac{1}{\text{Rev.}}}$$

or, in simple language, the diameters of shafts for equal work vary inversely as the cube roots of their revolutions. Numerically expressed, if the revolutions should be, as 1 : 2, the diameter would vary, as

$$1 : \sqrt[3]{\frac{1}{2}} \text{ or } 1 : .794$$

The weights of shafts, it is well known, vary as the squares of their diameters; that is, a shaft twice the diameter of another has four times the weight. When we expressed the diameter in terms of the revolutions, and as varying, as

$$\sqrt[3]{\frac{1}{\text{Rev.}}}$$

D^2 must vary, as,

$$\sqrt[3]{\left(\frac{1}{\text{Rev.}}\right)^2}$$

and, numerically expressed, when the revolutions are doubled, the weights become, as,

$$1 : \sqrt[3]{\left(\frac{1}{\text{Rev.}}\right)^2} \text{ or } 1 : .794^2, \text{ or } 1 : 1\ 630$$

The horse power absorbed by the friction of a shaft is expressed by H. P. = Weight of shaft in lbs. × co-efficient of friction × circumference of shaft in feet × revolutions per minute ÷ 33,000.

2. The horse power absorbed by the friction due to the weights of the pulleys is expressed by H. P. = Weights of pulleys in lbs. × co-efficient of friction × circumference of shaft in feet × revolutions ÷ 33,000.

In this investigation the diameters will vary inversely as the revolutions of shafts, but how will the weights vary with the diameter? From all the data I have at hand I find the weights to be nearly in proportion to their diameters. The error is in the direction of the smaller pulley, being proportionately a little lighter; but in this investigation, in order to keep it reasonably simple in its mathematics, I will assume the weights to vary directly as the diameters, and consequently, inversely as the revolutions; that is, the friction produced by the weight of the pulleys varies with the diameters of the shafts, which latter we have found to vary inversely as the cube root of the revolutions, and in the numerical example of a ratio of speeds of 1 : 2, the loss would be as

$$1 : \sqrt[3]{\frac{1}{2}} \text{ or } 1 : .794$$

The absolute weight of pulleys in a cotton mill is probably very nearly the same as the weight of the shafts. Col. Webber in his "Manual of Power," page 52, gives a list of weights of shafts and pulleys which bear the ratio of 1 : 1.18. D. K. Clark, an English engineer, gives the ratio of weights of shafts to pulleys and tension of belts as 1 : .75. If the weights of the pulleys were directly proportioned to the weights of the shafts, the loss or gain of power would be nothing, as it is in shafting; but in an exact comparison like this, we can assume the absolute weight of pulleys to be the same as the weight of the shaft at its lower speed, and to compare with absolute weight of pulleys at higher speeds reduce in the proportion shown above.

3. The belt tension would not be materially affected by a change of speed of shafts. The error would be in favor of the slower speed, for there the pulleys are of one size, and in the case of the higher speed they are of different sizes, which gives less belt adhesion for the same tightness, or the belt must be tighter to give the same adhesion. But assume it to be the same, then, by algebraic computation, we find that numerically expressed, if the ratio of revolutions should be as 1 : 2, the loss by belt tension would be as

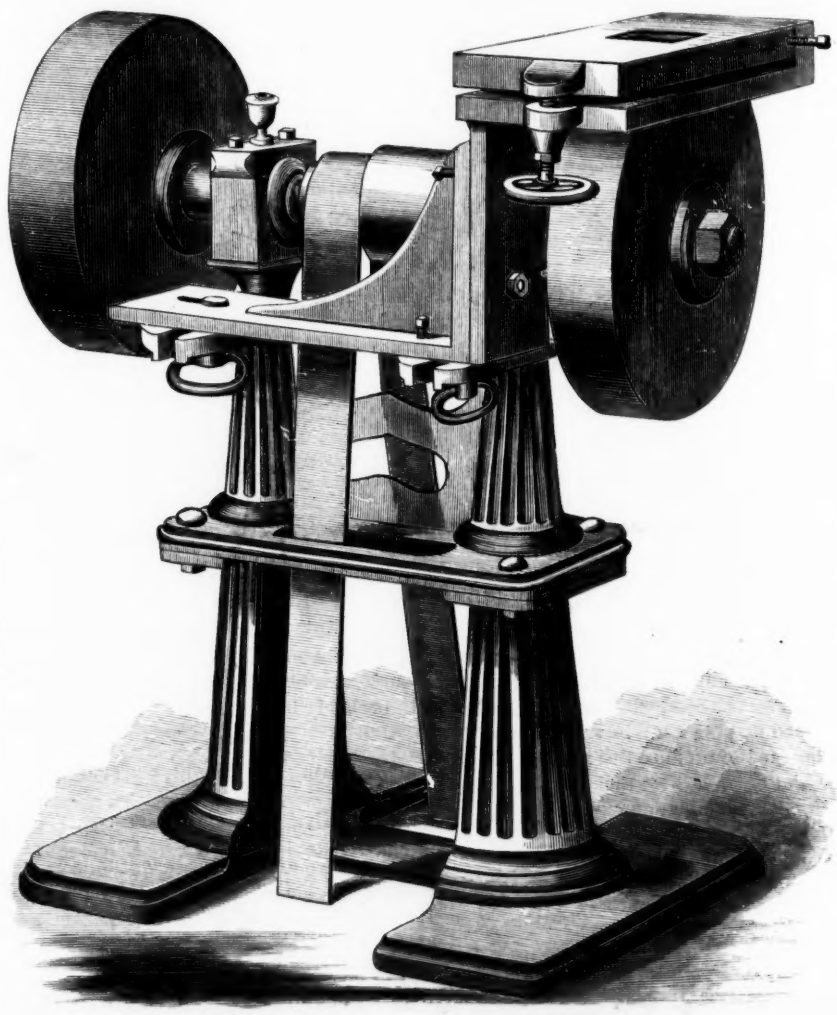
$$1 : \sqrt[3]{2^2} \text{ or } 1 : 1.587.$$

Now that we have found that, by increasing the speed of line shafts, we save nothing in the friction of the shaft itself, that we save something in the friction due to the weight of the pulleys, and that we lose a good deal due to the friction of shaft produced by the belt tension, let us find the absolute losses in an assumed case that is not far from a practical one, and a hypothetical case.

A line shaft, 400 feet long, driven in each case by a 42 inch pulley, to be run at either 150 revolutions or 300 revolutions; the diameter to vary with the gross power transmitted through it according to the formula

$$D = \sqrt[3]{\frac{\text{H. P.} \times 100}{\text{Rev.}}}$$

This line shaft to transmit 12 H. P. net in each case. In the first case to 100 looms, each requiring .12 H. P. as a mean power but when in practice a 1¼ inch belt is necessary on a 14 inch pulley to drive the loom at 150 revolutions; the line shaft to make either 150 revolutions with 14 inch pulley, or 300 revolutions with 7 inch pulley. The second case to be one of perfectly uniform work, more like that of a spinning room, where the belts are tightened no more than is absolutely necessary to do the required net 12 H. P. work; speeds to vary as 150 to 300 as before.



EMERY GRINDER WITH TABLE ATTACHMENT.

While the loom requires only .12 H. P. as an average power, its momentary power is very much greater. Just how much, we do not know, but it is known that a 1¼ inch belt is necessary to do the work well. The loom having a 14 inch pulley, making 150 revolutions will obtain .12 H. P. with a force of 7.2 lbs., or 4.8 lbs. per inch of width of belt. This is about one-tenth ($\frac{1}{10}$) as much as is safe and customary to transmit through a single thickness of belt.

I will take an extreme case, but yet not an unreasonable one: Let us assume the tension to be 10 times as great as is necessary to do the mean work and carry out a calculation for the following table based upon that tightness of belt.

The following table has been prepared to show the four losses, viz., that due to shaft, pulleys, belts and driving belt, under the constant useful work of 12 H. P. at either 150 or 300 revolutions per minute, and either intermittent work like that of looms, or perfectly uniform work more like that of spinning, with no needless belt tension whatever. The co-efficient of friction is 3%.

The formula by which the work of friction is found is:

H. P. = weight of shaft, pulley and belt pull × co-efficient of friction × by distance in feet the surface of bearing moves per minute ÷ 33,000.

In the above table, the diameters and weights of the shafts vary slightly from the amount the previous deductions would give for the reason that the *gross* horse powers are not uniform.

The driving belt being in every case only tight enough to do the necessary work, observe the small amount of frictional work absorbed by it. On the other hand the machine belts when ten (10) times as tight as is necessary to do the mean work, absorb a very great amount of frictional work.

It will be noticed that with a co-efficient of friction of 3%, under the most favorable conditions the least frictional work is 6.55%.

Attention is also called to the small loss at the driving pulley, being only from ¼ to ⅛ of 1% of the total work.

I think the table will bear study, in showing conclusively that needless belt tension is a source of loss of power that is aggravated at high speeds, and that under the most favorable conditions, higher speed implies greater loss of power.

LOOM OR INTERMITTENT WORK, 12 HORSE POWER NET.

Revolutions per minute.	Horse Power Gross.	Diameter of Shaft in inches.	Weight of Shaft in pounds.	Weight of Pulleys in Pounds.	Machine Belt Tension on Bearings in pounds.	Driving Belt Tension on Bearings in pounds.
150	13.76	2.061	4497	4497	14.400	5.50
Percentages	14.68%		2.757%	2.757%	8.829%	.337%
300	14.58	1.695	3040	3571	14.400	292
Percentages	21.48%		3.066%	3.60%	14.52%	.284%

SPINNING OR UNIFORM WORK, 12 HORSE POWER NET.

150	12.79	2.043	4419	4419	1440	512
Percentages	6.558%		2.686%	2.686%	.875%	.311%
300	12.93	1.63	2814	3508	1440	259
Percentages	7.778%		2.73%	3.403%	1.397%	.251%

Emery Grinder with Table Attachment.

We present herewith an engraving of an emery grinder with table attachment, made by the American Twist Drill Co., Meridithville, N. H. This machine is especially designed for producing flat surfaces on such work as keys, gibs, and larger pieces, and may be used on a variety of work that would otherwise require planing. The table, which is on the top a plain flat surface, serves as a guide in the reproduction of a similarly flat surface, the means of adjustment to compensate for the wear of the wheel being clearly indicated in the engraving. On the end of the arbor opposite the table attachment a wheel for general work is mounted, as shown. The table attachment is also useful in connection with a polishing wheel for polishing flat surfaces, the table serving to steady the work, so that large, flat surfaces may be polished that cannot be done by holding them against the wheel without the table.

Some eighteen months ago the Southwark Foundry and Machine Co., of Philadelphia, had occasion to order a number of machine tools from England for use in their manufacture of the Porter-Allen High-Speed Engine. The order was given partly because of the length of time they expected to have to wait for American tools, owing to the pressure of orders in this country. Two or three weeks ago, after several successive dates for the prospective delivery had been fixed and passed, the last of the English tools arrived, and was set in place, showing that John Bull can fall behind his promises quite as far, and with as good a grace, as Brother Jonathan, when pressed with business.

Reports from different sections of the country indicate that more agricultural implements will be sold this year than in any other in our history. The great influx of emigrants has assisted to subdue and put under cultivation a large extent of new farming lands in the West. With fair crops, the products of the soil this year will be immense.

A Spring Face for Puppet Valves.

BY GRAM CURTIS.

A PAPER READ BEFORE THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

Some years ago, in overhauling a large compound engine, the difficulty of keeping tight the Cornish valves, with which it was fitted, suggested to the writer a change in their mechanical construction by which leaking, arising from the difference in expansion between the bell and the seat, is avoided. In modified form the device is applicable probably to any kind of double-seated puppet or throttle valve.

In the ordinary form of these valves, especially with large ones, to insure tightness the metal must be perfectly homogeneous, and the bell and seat should be cast at the same time and from the same ladle. They must then be carefully turned and scraped at the same temperature, and afterwards ground in place under steam pressure.

The change in mechanical construction referred to is intended to do away with all these precautions, except that of grinding the valves to the seat; it consists in the introduction of a *spring face, A;* in other words, the carrying of one of the faces of the valve on a thin, flat, or a corrugated elastic ring. This face is, of course, so placed that the pressure of the steam shall hold it to its seat, and it must be so adjusted that it shall seat a thirty-second to a sixty-fourth of an inch in advance of the other. The face is made a heavy ring, in order to resist any deflection from the elastic ring which forms a part of it.

The joint between the valve and the elastic ring may be made tight by a coating of red lead, and bolting down the follower upon it, as shown in Fig. 2, leaving enough of the elastic ring free to insure sufficient motion.

In Fig. 1 the outer edge of the ring is swelled, or slightly upset, so that when the follower is screwed down the crushing of this swelling will render the joint steam tight. A copper wire laid on a groove in the bell under the elastic ring might be substituted for this swelling, or the outer edge of this ring might be brazed to the bell.

It is obvious that a number of ways for securing a tight joint might be suggested, and with any of them, and a *spring face* properly adjusted, the valve would always remain steam tight

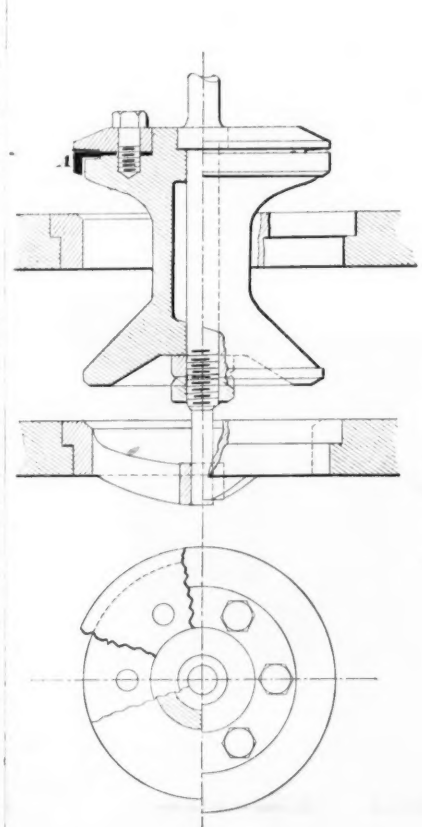


Fig. 1

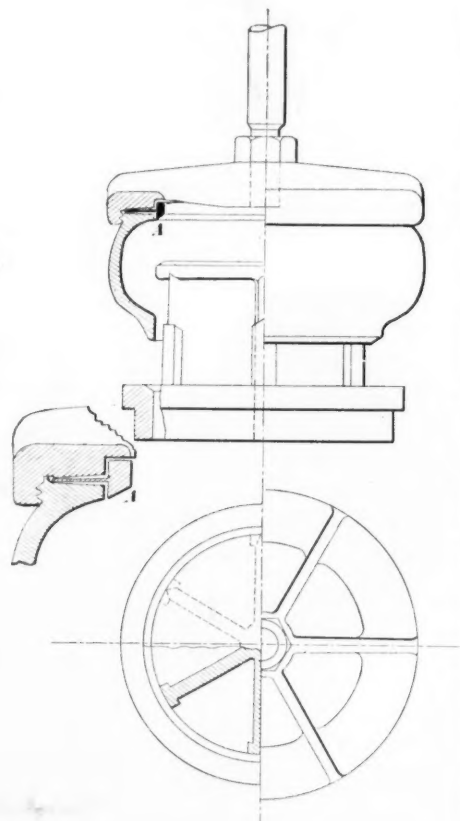


Fig. 2

New Adjustable Reamer.

For ordinary purposes in the machine shop, the sizing reamer is depended upon for keeping work to the standard diameters. A serious difficulty in the way of preserving sizes by the use of the ordinary fluted reamer, is in the fact that no matter how accurately it may be made to serve its purpose when new, or no matter how carefully it may be used, it gradually but surely loses its size until it entirely fails to serve the desired purpose.

Various plans have been resorted to with a view to produce a reamer capable of a ready adjustment, so that as the cutting edges wear away from size they may be expanded, or set out to compensate for the wear.

The accompanying engravings, representing in Fig. 1, a side view, and in Fig. 2, a longitudinal and cross section, illustrate a reamer of this class, the invention of Andrew Saunders, of Yonkers, N. Y., several of which have been in use during the past year in the shops of D. Saunders' Sons, at Yonkers.

As will be seen the body, *A*, of the reamer, is provided at one end with suitable squares for the application of the wrench while the end of the cylindrical portion is made of a diameter slightly less than the principal part of the body, with which it is connected by a tapered section, as shown in Fig. 2, in which these features are exaggerated for the sake of prominence. The object of this construction is that the diminished end may just fill the hole to be reamed and so serve to steady the reamer while being used.

The body is finished with a taper dovetail slot *b*, in which is fitted the cutter *B*, so as to be rigidly held against the thrust of the cut, and yet be capable of endlong movement by the application of a moderate force. It is evident that, after the whole is finished to any determined diameter, a motion of the cutter, in the inclined slot, in a direction towards the end carries the cutting edge outward, and so provides for reaming a hole of a larger diameter, while a corresponding motion in the opposite direction will provide for reaming a smaller hole.

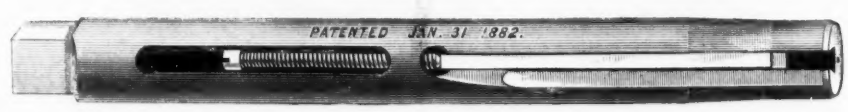


FIG. 1.—SIDE VIEW OF REAMER.

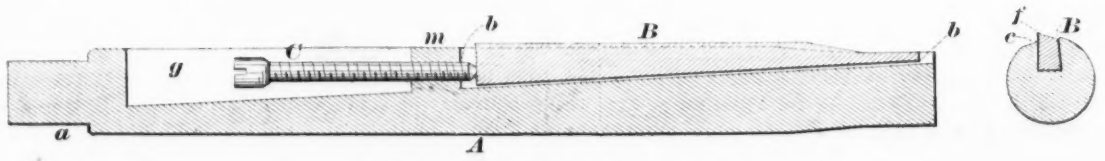


FIG. 2.—CROSS SECTION OF REAMER.

In operation it will be seen that the body has a bearing in the hole being reamed for the greater part of its circumference, thereby tending to keep the cutting edge steady and not subject to the duty of forming a guide.

The cutter can at any time be sharpened, and afterwards adjusted to correct size, or can at any time be adjusted to ream a hole over-size should it be desirable for special purposes. Of course it will be readily understood that a hole smaller than standard size cannot be reamed.

For large sizes of reamers and for reamers to be operated by power, two or more cutters can be used.

The *Railroad Gazette*, of May 12th, has information of the laying of 220 miles of new railroad, making 2,503 miles thus far this year, against 1,018 miles reported at the corresponding time in 1881, 1,264 miles in 1880, 493 miles in 1879, 312 in 1878, and 354 miles in 1877.

Ezra F. Landis, of Lancaster, Pa., writes us about a plan of hastily annealing steel for millers and other cutters, lately tried by him, which insures the articles coming out in proper shape. He heats the articles to a low cherry red, places them upon a smooth iron plate, covers with an old fruit can, and, with a little dry ashes or dust around the edge, makes the chamber nearly air tight. The articles are then allowed to cool, when they are found to work nicely. The idea, though possibly old, was new to him, and will probably be new to many of our readers.

Learning the Moulder's Trade.

BY THOMAS D. WEST.

When a young man starts out to learn the moulder's trade, about the first thing he does is to get a trowel, stick it in his pocket and call himself a moulder. He comes to his work finely dressed, with a cigar in his mouth and his talk is about anything rather than what he is doing. This is not the case with all beginners, but it is true of the majority of them. Once in a while a young man who has more *sense* and less *conceit*, instead of calling himself a moulder takes every opportunity to make himself one. He is careful not to give offence by speaking slightingly of work he knows nothing of, and at once makes friends of those whose skill he may profit by. He may wear good clothes, and perhaps smoke a cigar, but there are different ways of doing such things. Instead of spending his evenings around saloons, he may be found a member of some debating society discussing the elements of pig iron, or he is home making a drawing representing the way some moulder is making a difficult casting, which drawing he will preserve for future reference. When a moulder loses a casting he will note the cause and profit thereby, and when he loses a casting himself, he will welcome and profit by any advice or assistance in order that the next one may be good. At his work he will be diligent and careful and always ready to give a "lift" or help any one that is in trouble. He is not afraid of asking questions, and always aims to make the second casting better than the first one. He will be patient and not be looking for the foreman to give him work that he is not capable of executing. When he borrows a tool it is sure to be returned, and his own tools he willingly lends and keeps them clean and in place. He never has much to say and attends strictly to his own business.

These qualifications in a young man will make friends, without which his progress will be slow. The greater part of our knowledge is obtained from others. We are indebted to thousands of people for what we know of the moulder's trade.

Some beginners will say that they do not get any show; that the boss is giving it all to others. It is hard for an outsider to pass an opinion on this. Very often apprentices overrate their ability, thinking they are capable of taking work that they would only lose if given them to do. It is a great failing of young men, and, in fact, of the human race generally, to think they can do things they see others doing. If we could only "see ourselves as others see us," we would, in many cases, be more contented in our situations.

It is often the case that a worthy apprentice is not advanced as he should be, on account of some prejudice, or sometimes an established principle of keeping the boy down. A young man should find out the character of the establishment before he makes an agreement to learn the trade there. A shop that makes a speciality of two or three different kinds of casting, is no place to learn the moulder's trade. Try and get a start in a good jobbing or steam engine foundry; such shops as these generally have all the science of the art of moulding practiced in them, and in such shops, should the foreman feel inclined to keep a beginner on one job all the time, he could very seldom do so. Of course he can keep changing you from one inferior job to another, and should you see all the apprentices treated in a similar manner, it is not of much use to ask to be advanced. But, should you see others going ahead, (if you are sure the fault is not yours), in a polite manner ask to be tried on better work. Whether the answer is favorable or not, continue on with your work, doing the best you can, for, if the foreman will not reward any merit that you may possess, you will be noticed by some one, sooner or later, who will recommend and advance you.

Under any circumstances, faithfully serve your time, then leave and go to some other shop, wherever you can get a job.

You may find quite different plans for making work practiced there; but, with a good mechanical judgment, you will get along all right. The first day in a new shop is always the worst. I have seen men who have worked the most of their lives in the shop where they served their time, and in which they had the leading work and were reckoned good mechanics, start in a strange shop and be so nervous and simple in their actions that the old hands would question their being moulders.

As a general thing, the class of men who laugh at a moulder in a strange shop are the narrow-minded ones who, having had experience several times over with every piece made, have forgotten their own failures in working up to their present knowledge. A man of good sense, and who is a *thorough mechanic*, will not be guilty of such actions. On the contrary he will show the stranger where he will find the flask needed, and will tell him if there has been any trouble in the

previous moulding of the job; he will show him where there are gaggers hidden, and, in fact, do everything that he can to assist him Should he have any idea of opposition, he will wait until the stranger has got a fair run of the shop's tools and ways, when it would be a more manly and even race to see who is the best mechanic.

A thorough knowledge of the moulder's trade cannot be learned in any one shop, nor is it a sign that a moulder thoroughly understands his trade because he has worked in a great many foundries. He can see how things are done by traveling, but the class of work that would advance and instruct him is hardly ever given him to make. Go into any foundry and ask how long the men that are working on good jobs have been there, and the answer will generally be, from six months up to a lifetime. A stranger must stay long enough in a shop to show some merit before a practical foreman will trust him with responsible work.

A young man traveling to advance himself should, when possible, engage only in the best shops to be found, and there he should stay at least for one year. After thus working for ten years in as many different shops, he can blame no one but himself if he is not a good, practical moulder, able to make almost anything in the branches that he has practiced.

Thorough, first-class moulders are very scarce, as such men must be capable of melting their own iron, and making any castings that come along, in loam, dry sand, or green sand.

It is very seldom that the three branches are learned, or practiced, by one man, one reason being that most large shops generally have work enough to keep a constant number of men working steadily in each of the three branches. Another reason is that it is a little too much for most men to practically master.

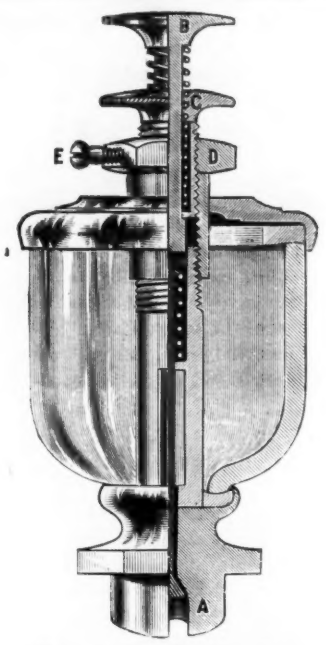
A man may be good on green sand, and perhaps fair on dry sand and loam, or all right on loam and dry sand, yet in green sand not amount to much.

There are two ways of learning the moulder's trade; one is *do as you see others do*, and the other is to know the reason *why you do so*. Moulders very seldom ask themselves: Why is such a thing done in order to have the casting a good one? They are told it is to be done; they do it, and there let the matter end.

There is a principle and a cause involved in almost everything that is done to make castings successfully, and he is the farthest advanced in the art of moulding, who has made them a study, so as to thoroughly understand the cause and effect of what he does.

It has been suggested to me that I should write a few articles for apprentices. Webster says that an apprentice is one that is bound to another to learn a trade. Some trades may be learned during the allotted time of three or four years, but for a young man to think that when his apprenticeship is served, he has learned the moulder's trade, is assuming too much. A moulder is an apprentice as long as he lives, as there is not a day that passes that something cannot be learned. Whenever any man gets to thinking that he knows it all, or that he cannot learn any more, he should stop working. He will never be a success. Writing to give information to a beginner may sometimes be well enough, but the beginner must first see some bad results of something that he has done, in order to fully understand his trade.

The first year of a beginner's time is always more or less of a loss to his employers. You may tell him what to do and how to do it, but he must have practice before, as a general thing, any information that may be given to him is fully understood, or its value comprehended. Articles are often written for apprentices, when the author ought really to admit that he intended them more for what might be called practical men, and that he assumed the simpler title to cut off censure and criticism. Such authors should let their writings be for the old as well as the young, for there are none of us so old that we cannot learn.



NEW CRANK-PIN OIL CUP.

A beginner in one shop could very often give some valuable information to an old experienced hand in another shop, and as for a knowledge of the principles or manipulations of the moulder's trade, there are as many old hands as new ones that require to understand them better.

New Crank-Pin Oil Cup.

The problem in the design of the crank-pin oiler illustrated herewith, was the production of an oil cup that should have a regular feed adjustable in any degree as to quantity of oil fed, and at the same time, and without disturbing the adjustment, which could, while the crank was in motion, be manipulated to inject an additional amount of oil on the journal.

To accomplish these ends it will be seen that in the bottom of the cup, at *A*, is a valve which is adjusted to give the required feed (more or less) by screwing down the plug *C*. To lock this firmly in position the jam nut *D* is screwed down tightly on the rim of cup, and the binding screw *E* tightened up, which secures the whole permanently. The cup is now in adjustment for regular continuous feed.

As is well known it is sometimes desirable, or absolutely necessary, to give the bearing of the pin a dash of oil without stopping the machinery. To provide for this the plunger *B* is fitted in such a way that by striking it lightly with the hand, as the pin revolves, the valve *A* is forced from its seat, allowing the oil to pass freely to the bearing, a spring immediately returning the valve to its original position.

In filling the cup the plug is removed, the several parts remaining fixed in their positions, so that when the plug is replaced the adjustment of feed has not been in any way altered.

These oil cups, which are designed for use on stationary and marine engines, or in fact on any description of crank pin, are manufactured by J. E. Lonergan, 241 & 243 Arch Street, Philadelphia, Pa.

New Fifteen-inch Shaper.

We illustrate herewith a new shaping machine recently brought out by the Hendey Machine Co., of Torrington, Conn. It has a stroke and cross feed each 15″, and will plane a piece 12″ high. This machine, although made strong and heavy in its parts, is at the same time especially adapted for light and rapid work.

It has a two-change pulley for working hard and soft metal, and quick return on back stroke.

The shafts are of steel; rack and gears cut, and slots and holes in table cut and drilled from solid metal.

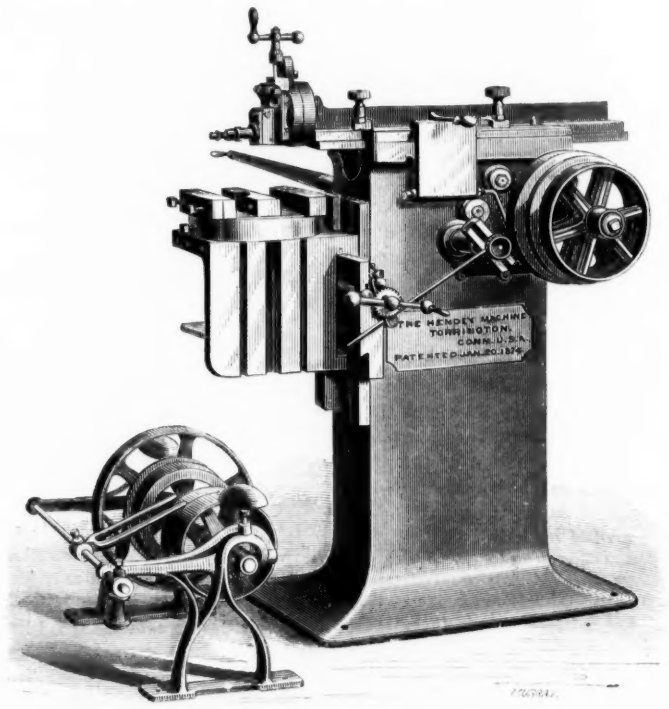
All sliding surfaces are scraped, and wrought iron work, such as screws, nuts, wrenches, &c., is case-hardened.

The feed screw is of steel, cut with square thread.

The vise for holding the work is fitted with hardened steel jaws operated by steel screws.

The weight of the machine is 1,000 pounds.

A Western paper announces that upon the occasion of a recent boiler explosion in the neighborhood "between three and four men were killed."



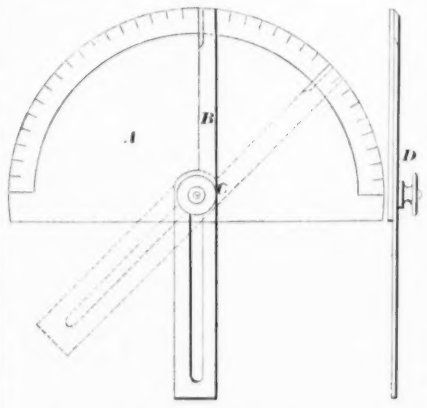
NEW FIFTEEN-INCH SHAPER.

LETTERS FROM PRACTICAL MEN.

Handy Bevel Gauge.

Editor American Machinist:

Inclosed you will find the sketch of a



bevel gauge which I have just completed for my own use in the shop. It is shown complete in two views by the accompanying cut. It was made of a piece of an old saw $\frac{1}{16}$ inch thick.

The degrees of the protractor, *A*, were marked in a gear cutter.

The blade *B*, is slotted and is held in any position by a milled nut. The dotted line, *C*, shows one of the various positions to which the blade may be adjusted. *D* shows an edge view of the tool. The following are the principal dimensions of this tool: Diameter of protractor, 4″; length of blade, 4″; width, $\frac{7}{16}$″; length of slot, $2\frac{7}{8}$″; width, $\frac{3}{16}$″; screw, $\frac{3}{16}$″ diameter.

JOHN G. EDWARDS, JR.

Wilmington, Del.

Information Wanted on Foundry Matters.

Editor American Machinist:

In your paper just received (Vol. 5, No. 20) I notice Mr. West's reply to my inquiries last January, desiring details of the arrangement with which he melted so fast. Mr. West has answered very fully and pleasantly, and through the same medium that I reached him before; I wish to tender him my thanks. To explain why I asked Mr. West so many questions, I will say it was not curiosity but pure selfishness. I was after information, and just at that time I wanted it badly. I am using a Mackenzie Cupola(continuous tuyere). The diameter at the smallest part of the cone or tuyere is 28″; diameter of hearth below cone 39″; diameter of cupola above the cone 41″. These dimensions are internal, and the shape is round. The external diameter of the cupola is 51″, and the space between the outer shell and the cone is a wind space, equivalent to the wind belt around Mr. West's cupola. The wind is delivered into the charge in a continuous sheet $1\frac{1}{4}$″ perpendicular, and the entire circumference of the interior of the hearth, and through the small end of the cone into the charge.

The blast is supplied by a No. 7 Sturtevant blower, the revolving wheel of which is 31″ diameter; the speed by the indicator was 2,255 revolutions per minute.

When running at work the pressure right at the tuyere was sufficient to balance a column of water $20\frac{1}{2}$″ high, say 11.9 ounces per square inch. We use the best hard lump (Lehigh) anthracite coal. We use one-third No. 1 American pig iron, one-third No. 2 American pig iron and one-third good scrap. Our mode of charging was 500 pounds coal on bed, bringing the bed about 13″ above tuyeres. On this charge 2,400 pounds of iron, then 100 pounds coal and 1,200 pounds iron, and continue in this manner until I get the amount I want to melt; Thus for a heat of 7,200 pounds we would use 900 pounds coal or 1 to 8. This melts the iron good and hot, suitable for jobbing or any light work. But my trouble is that it takes me 2 hours to melt this 7,200 pounds of iron with this arrangement.

I am well aware this sounds very slow compared to Mr. West's splendid result; but, nevertheless, it is a true story. My experience is so different from his that I earnestly desired to learn something from him, and this must be my apology to you and him for troubling you.

I cannot yet see why I should do so much poorer than he does. My fuel is good, my iron is good, my cupola is very near his in size, my wind pressure is greater than his, area of tuyere openings is not much different, but the result is very much slower melting. I think the continuous tuyere must be as good as his three openings—only I have varied the depth of wind opening and the charges of fuel and iron; but the above record is about as good as I have obtained, with more or less wind or with more or less coal.

I think my wind is delivered into the cupola with less loss of pressure than in Mr. West's case.

The diameter of my fan wheel is 31″, and speed 2,255 revolutions per minute; this would give to the circumference of the fan wheel a velocity of nearly 18,300 feet per minute. The pressure due to a velocity of 18,350 feet per minute is 12 ounces per square inch. The pressure I got at work was $20\frac{1}{2}$″ of water, or nearly 11.9 ounces. This pressure was measured right at the tuyeres, and shows but little loss in friction in the

conducting pipes from fan to cupola. If the diameter of Mr. West's revolving wheel of fan was 45″, and speed 2,400 revolutions per minute, it ran with a circumferential velocity of 28,320 feet per minute—equal to a pressure of nearly 25 ounces. The capacity of fan was abundant for the tuyere openings; and therefore, if he got an average of 13½″ of water, or, say, 7.8 ounces per square inch, at his tuyere, there must have been a great loss in friction in his conducting pipes.

I hope I have not trespassed too much upon your time and space. You seem so earnest in your desire to have improvements made, and to have your readers reap the advantage of practical experience, that I have made bold to trouble you with this plain statement. It sounds like a failure compared to Mr. West's record; but perhaps some of your readers can point out where I am wrong, and thus many may profit by my failure. We sometimes learn more from failures than from successes—learn to avoid error. R.

Determining the Proper Heat for Hardening Steel.

Editor American Machinist:

In reply to the allusion of Mr. Dicks to my recital of experiments in drilling Mushet steel, permit me to say that the pieces which were drilled by me were not annealed, and that some of them were broken knives from nail machines in the same condition in which they had been used for cold cutting. While it is not often necessary to drill or otherwise cut material as hard as the steel referred to, the fact that there are cases in which not only hard metallic articles but even glass must be drilled, should lead to investigations showing what is required both in quality of steel, and the proper treatment in working, annealing and hardening it to produce drills or other tools with which tempered steel or glass may be cut. First, a steel of higher temper (*i.e.* containing more carbon) is required than for tools for ordinary uses. Secondly, great care must be exercised in heating, especially for hardening. Hardened steel may be, if hardened at the right heat, stronger with the temper undrawn than when drawn down to a blue even, if hardened at a heat too great.

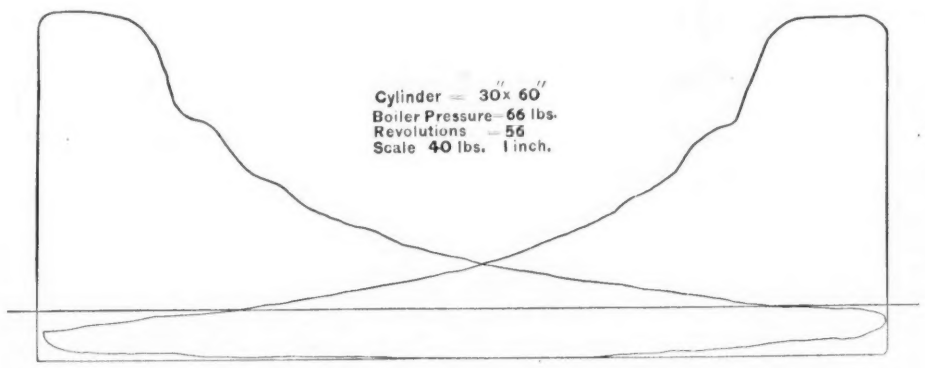
As for cutting extremely hard substances the requisite qualities in tools are extreme hardness and tenacity. The effort should be in hardening to adopt the exact heat that will produce the condition of hardness required without drawing the temper.

Steel hardened at exactly the right heat becomes much finer in grain than before hardening, which is a very desirable condition not attainable by hardening at a higher heat and drawing the temper. Drawing the temper will increase the tenacity, if the grain has been made coarser, or even left as coarse as it was before hardening. By too great heat, it will remain in a coarse condition no matter how low the temper is drawn.

Steel of different qualities and tempers requires different degrees of heat for hardening, ranging all the way from a bright red or yellow down to a dark red that needs to be seen in the shade to determine that it is red at all. Yet we have the advice of a writer on the subject, to heat a drill for drilling glass, "white hot and plunge in quicksilver." The condition of the steel itself after hardening is the test as to proper heat. Steel which may be heated white hot, or yellow, or even bright red, for hardening, is not the proper article for drilling glass. Turpentine combined with different oils in different proportions may be well enough in its place, but when glass or other hard substances are to be drilled, these mixtures will be found of no use unless the drill is possessed of greater hardness then the article to be drilled, and at the same time be of sufficient tenacity to stand the strain without breaking. Too much dependence is often placed upon certain methods in heating and cooling steel for annealing or hardening, and too little care taken that the heat shall be just right, and the conditions for cooling carefully determined.

In conversation not long since with the superintendent of a large manufactory in which hundreds of hands are engaged in turning, milling, drilling, &c., I was much struck by this statement: "We formerly thought it exceptionally good work for a tool from our best steel to stand three hours without grinding, in turning a very hard and difficult class of our work, but as the result of experiments recently made with a different steel we have had tools stand two entire days, without grinding, on the sane work." Who says that such experiments don't pay? Why should not more experiments be made to test the efficacy of the *right heat* against all the specific rules patented and otherwise, which to many steel workers are a positive injury, from the fact that depending upon the method they grow careless about the heat?

Waterbury, Conn. S. W. GOODYEAR.



Bourdon Spring Indicator.

Editor American Machinist:

In "Chordal's" letter on Indicators in the AMERICAN MACHINIST for Dec. 20th, 1879, in mentioning an indicator that uses the Bourdon spring instead of a piston, in order to draw out the inventors he ventures the opinion "that it won't work as it will not respond quick enough for an indicator." As I have not seen any response to this challenge in your paper, and as I happen to have an indicator that does use the Bourdon tube, I take the liberty of sending you a pair of cards taken with the said tube indicator from a Corliss condensing engine. Of course the spring is much heavier than the ordinary gauge spring, but it is so sensitive that by blowing in the steam inlet a child can move the pencil. The only drawback that I have found thus far is that the atmospheric line must be taken just as soon as the pressure is removed or it will be too low. Now I would like to hear what "Chordal" has to say about the cards I enclose. S. F.

Germantown, Penn.

Simple Taper Boring Device for Lathes.

Editor American Machinist:

In your Letters from Practical Men there has lately been published much useful knowledge in relation to boring in general.

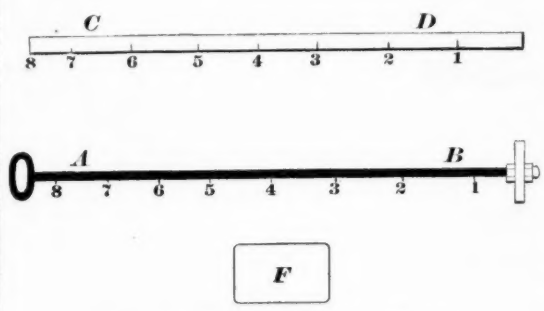
But as many of your correspondents are no doubt aware there are many shops where it is impossible to find a boring apparatus all ready made to bore a taper hole in an odd job, for which it would not pay to make a special bar. With your permission I will contribute an idea which is original with me and may be new to some others and which has served me well on different occasions. In the accompanying sketch, *A* represents a lathe chuck attached to the live spindle in the usual way and holding the piece of work *C*, to be bored. *B* is the dead center set over to suit the desired taper. *D* is the carriage, with a boring tool in the tool post, as for ordinary boring.

A straight piece of turned shafting or mandrel *E* is placed upon the centers and the handle removed from the screw that operates the slide for the tool post and the screw run in so that the collar cannot strike the edge of the carriage, when the tool enters the largest part of the tapered hole. Set the tool block so that the tool post will rub against the mandrel *E*, which is to act as a guide, adjust the tool and go ahead using the feed as for straight work. To avoid back lash or lost motion I hook a lathe dog over the tool post with the tail back of the mandrel, and tighten the set screw so that the tail will just touch the mandrel *E*. This may be done by "shimming" up the dog and setting up the set screw tight. By throwing the centers of the mandrel *E* out as in a mandrel for turning eccentrics, the position of the tool may be adjusted by giving the mandrel a partial revolution before beginning a new cut. I have used the arrangement herein described to bore a straight hole in a lathe where the spindle did not run parallel with the ways, by setting the tail spindle so as to bring the mandrel *E* parallel with the live spindle.

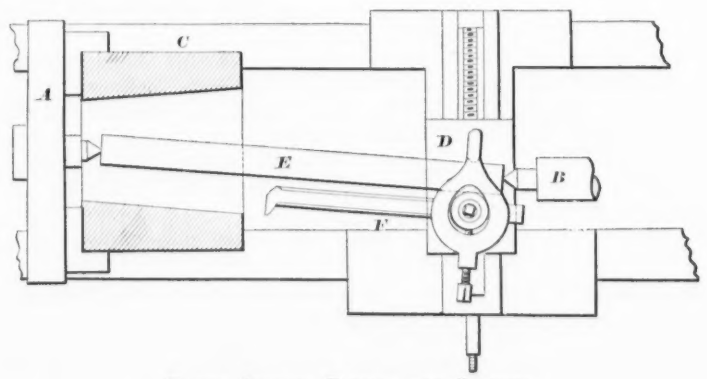
This arrangement is quickly applied, is inexpensive and a trial will convince the most fastidious.

W. E. G.

Fremont, Ohio.



TOOLS FOR PLUGGING BOILER TUBES.



TAPER BORING DEVICE FOR LATHES.

A Simple Way to Plug a Leaking Tube.

Editor American Machinist:

Almost any engineer who has had charge of a marine boiler will agree with your humble correspondent when he says that a leaky tube is sometimes a source of much trouble and annoyance, and more especially so when the tube is not accessible via the back or connection. The following is intended to show how this may in a measure be alleviated: *A B*, in the accompanying sketch, consists of a piece of ⅝″ iron rod, divided and marked in feet and inches and long enough to reach through the tube and be handled from the fire room. At one end is a rubber washer of the same diameter as the inside of the tube in question, secured by nuts and washers. A piece of an old foot valve or air-pump bucket valve answers the purpose very well. *F* is a soft pine plug, its diameter just great enough to allow it to drive snugly through the tube. *C D* is a piece of tough wood large enough to drive the plug *F*, and of the same length as *A B*, also divided into feet and inches. We first take *A B*, and insert it into the tube until the washer covers the leak. This may be ascertained by the effect it has on the sound of the escaping water. We then note the distance of the leak from the tube sheet by the marks on the rod, which we withdraw, and insert the pine plug and drive it into the tube with *C D*, until the marks on the wood, *C D*, correspond with those on the iron rod, *A B*. Withdraw *C D*, and the operation is performed. The pine plug, being dry when inserted, is expanded by the hot water, and in most cases answers the purpose for which it is intended—namely, to stop the leak until the fires can be hauled and a man put in the back connection to apply the usual appliances.

By using the rod, *A B*, the engineer can ascertain just how far the leak extends and make the plug accordingly. I would say in conclusion that if the tube is very dirty it is well to run a tube-scraper through it before using the rod, *A B*.

J. HUMPHREY CHALKER,
Engineer U. S. R. M.

Clinton, Conn.

Economy of Melting and Finishing Castings.

Editor American Machinist:

I have been reading the several articles in your recent issues, upon melting iron with the closest economy of fuel, from Messrs. Wishart, West and Kirk. Friend West's article in issue of May 20th presents the matter the most fairly and clearly of them all, as I understand it. His reasoning upon the question is: The iron has got to be melted, and, whether 7, 8 or 9, or 5, or 4 to 1, the iron must be made fluid to be cast into the mould. In my opinion, the more fluidity, the cleaner, sounder and more even the iron will appear after being cast, especially in the running of a cupola, where three or four different qualities of iron have to be charged for different work. Mr. West has in a previous article mentioned the trials of the foreman in charging his cupola, so as to know to any degree of certainty when his hard, medium and soft iron is coming out. There is this certainty about melting iron—you cannot melt it too hot, where two or three and sometimes four different brands of iron are in one charge. They are mixed more homogenial when the molecules are in their best separable condition, and that exists when the iron is in the most fluid state, or the hottest. *It takes fuel to make it so.* When you are figuring to save $1 or $2 in fuel, you often are wasting $25 before all is over. Call a moulder up for his iron, and give him a ladle that has a scull in it one-half inch thick from recent use, and with iron sluggish and dead, he starts to carry the ladle too full (as he has doubts as to its capacity), gets to his mould, pours before a skimmer can get to him, or he may not make the piece run, and dross gets in as a consequence. The result is the piece is condemned as being dirty. A casting may get to the machine shop, the iron may have been melted with Utopian or miserly economy, and in planing it a hard streak is found that costs more to get over and work down, than it would to have melted iron 6¼ to 1 in the foundry. Every ladle is bunged up, all requiring to be newly lined; aroundt he shop are small pigs of iron that the boys had to

dump out to save the ladle—in short it is discovered that there was not iron enough; about 1500 to a ton short. The iron is laying around the shop in those small pigs and in the sculls of these ladles, and instead of melting 6 tons, we better have melted 7½ tons; then we would have had margin enough for waste and would have melted the extra ton and a-half, and enough fuel would have been used to have melted the 6 tons into good hot liquid, so that it could all have been used and none dumped. All the ladles would have been in good condition, the cupola would have dropped better, less chipping out would have been necessary, less wear and tear of lining of cupola would have occurred. To a moulder nothing is so demoralizing as dead or dull iron. Hot, sharp, liquid iron is as welcome to him after a siege with dull iron, as a ray of sunshine is after a flood.

It must be a very indifferent foreman who literally squanders his employer's funds by melting his iron with too much coal, for there is nothing more easy to discover than when there is too much coal or coke in a cupola, as also to discover when there is not enough. Any one who knows how to run a cupola can tell in twenty minutes whether there is too much on his bed. It is not necessary to mention how, as that is generally known.

In my experience, to save $1 in fuel, per day, I have seeen $10 worth of castings lost. Ladles made necessary to re-line each day, and every moulder who came after the middle of the heat heaping imprecations on those who poured before him for their burying up the ladles, and swearing that the iron was no better than the raw pig in the yard.

Hartford, Conn. FOUNDRYMAN.

Economy of a New Furnace.

Editor American Machinist:

There is one error in your admirable condensation of my address at the recent meeting of the New England Cotton Manufacturers' Association, which I should be glad to have corrected.

You state that "it was found that the losses due to incomplete combustion were very small, the amount of carbonic oxide being only $\frac{8}{10}$ of one per cent; the proportion of loss from this incomplete combustion being seven to eight times the percentage of carbonic oxide." Such a quantity of carbonic oxide, and such a loss, equal to 5.6 to 6.4 per cent, would be far from small. In fact, five full consecutive weeks, with natural draught, gave respectively, with anthracite coal, during all the hours when dampers were open, 0.30, 0.25, 0.51, 0.20 and 0.22 per cent., a mean of $\frac{27}{100}$ of one per cent. One week, with the same boiler, and bituminous coal, gave, by day, 0.36 per cent., and by night, 0.37 per cent.

Mean number of hours that dampers were open each week, 68; mean number of hours per week that fires were banked and dampers closed, 57.5.

By night the carbonic oxide was: 2.15, 2.33, 3.18, 2.57; 4 weeks, anthracite (night observations not taken the first week), mean for anthracite 2.57 per cent.

The mean *loss* from this cause was:

	Days.	Nights.
Anthracite....	2.57 per ct.	27.17 per ct.
Bituminous....	0.31 "	2.24 "

In the Marland boiler, the carbonic oxide was:

1 week, anthracite, days, 0.08 per cent.
1 " bituminous, " 0.12 "

Dampers open 52 hours, closed 71 hours.

The loss by night could not be ascertained, as the dampers were so tight as not to permit any draft which could be detected by an extremely sensitive anemometer which clearly showed the effect of opening and closing an opening of 3 or 4 square inches in a furnace door with full draught on.

During the week which gave 0.51 per cent. carbonic oxide, and a loss from this cause of 3.38 per ct., special efforts were made during parts of two or three days, to produce carbonic monoxide by heavy and rapid firing, special samples being drawn off for half an hour at a time, for separate analysis. Such samples alone gave as much as $\frac{8}{10}$ per cent, and sometimes more than 1 per cent. But when mixed with the day's samples and averaged with all the days of the week, they simply raised the mean carbonic oxide 0.51 per cent.

It does not seem worth while to spend much money in efforts to "save" these small ratios, made as carbonic oxide mostly is, when the fire door is open, and *always* increased by admitting air above the fire.

J. C. HOADLEY.

29 High Street, Boston, Mass.

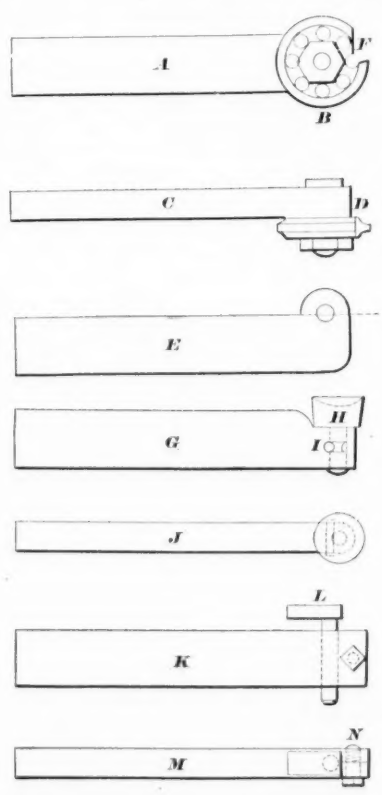
Shop Kinks.

No. 31.

BY L. F. LYNE.

TOOL FOR PRESERVING STANDARD SHAPES—DRILL HOLDER.

In various processes of machine work it is absolutely essential that uniform sizes and shapes should be preserved. Every machinist with any considerable experience knows the difficulty encountered and time required to fit up tools of special shapes, as, for instance, for cutting racks upon a planer or shaping machine or for finishing fillets or ogees upon different kinds of work. It is well known that when the tool is dulled by use it has to be annealed and reshaped, and this process involves the loss of more time and the risk of a variation in the shape. To obviate this trouble and insure a constant standard form, the tool shown at *A* of the accompanying cuts has been designed. A tool similar to this in appearance has been in use for some years, but differed somewhat in detail. The one here shown, likewise the others herein described are used in the shop of the American Watch Tool Company, Waltham, Mass. The body or shank of the tool *A*, is made of steel to fit the tool posts of either lathes or planers. The cutter *B*, is made of the best tool steel having holes drilled through it. A piece is then cut out as shown at *F*, to form



the cutting edge. The cutter is then hardened and bolted to the shank *A*. This tool is more particularly intended for cutting racks in a planer, but it may be used for other work, as described. For very heavy work it may be found an advantage to put a steady pin through the cutter to prevent it from turning, which is easily accomplished.

For lathes, the style of shank shown at *E* will be found advantageous, on account of raising the cutting edge which would be too low, as shown at *A*. These and other advantages will readily suggest themselves to the appreciative mechanic. The tool shown at *G* has a shank similar to *A*, while the end has a hole through it for the reception of the cutter, *H*. This cutter is held in place by the tapered steel pin *I*. The further details of this tool are shown in the plan *J*. The cutter, when dull, may be ground without difficulty, and when worn out, may be replaced, or various cutters of different shapes may be substituted, thus avoiding an unnecessary waste of steel in making shanks. A very handy drill holder for lathe work, designed by W. W. Hastings, in charge of the tool room of the company alluded to, is shown at *K*. It consists of a steel shank with a hole drilled near one end; a steel pin,

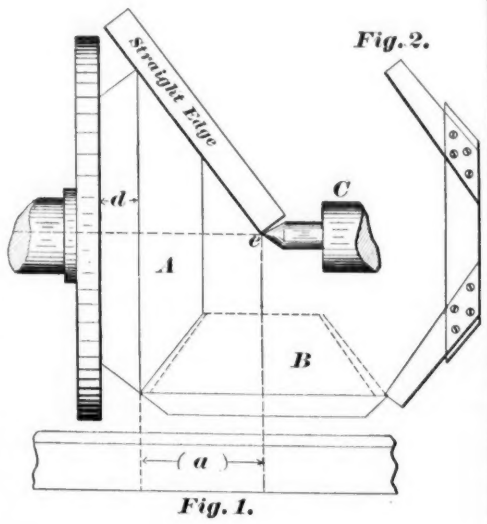


Fig. 1.

Fig. 2.

L, having a foot at the end, is fitted neatly to this hole. A slot is sawed from the end of the shank into the hole, and a screw *N*, inserted through the side to form a spring clamp, shown in the plan *M*. The advantages of this device are quickly discerned. The drill may be quickly adjusted or removed without the necessity of putting it through a hole, and the foot may be adjusted up or down to suit drills of all thicknesses.

Turning Bevel Wheels and Pinions.

BY A. FORREST.

Turning off the faces of bevel wheels and pinions, as well as cone friction wheels, is frequently required to be done in all general machine shops; and it is, or would be, amusing, if it was not so exasperating to a mechanic, to see the awkward methods resorted to to accomplish so simple a piece of work. In accompanying diagrams, Fig. 2 represents a device not infrequently met with, the "picture" of which is a sufficient discussion of its merits. If the writer did not know such to be a fact, he would hardly credit the statement that the turning of faces of bevel wheels is, more frequently than otherwise, intrusted to men who never dreamed, or heard of anybody else dreaming, that there is such a thing as a ratio of motion, and a corresponding angle of face and pitch contact to be considered in the proper formation of a pair of bevel-toothed wheels that are to run together. All that many machinists know, or care to know, is to place the rough casting in the lathe, pound it for half an hour or so with a half-grown sledge, and then turn it off until it very nearly fits a gap cut in a board by the pattern maker up stairs. The geometry of that gap, and its relations to the other wheel of the pair and its corresponding gap, would knock about one-half of the "skilled workmen" stone dead, if it should suddenly enter their brains at any point above the cheek bones.

In our diagram, Fig. 1, *A* shows a bevel wheel chucked on the face plate of the lathe; while *B*, in dotted lines, shows its complementary wheel in a suppositious position. The real position of such wheel, so far as dealing with the wheel in the lathe is concerned, might just as well be in the sand of the foundry, or even in the pile of pig iron in the back yard, if its diameter is known. *C* is the center of tail arbor brought to a distance from face plate equal to radius *a*, and distance *d*; *e* is the point of intersection of the axes of the two wheels produced.

If it is objected that the back centers are not sufficiently coincident with axes of live spindles in many lathes, all I have to say is, if a shop has lathes of this sort they should be brought into proper adjustment at once, or consigned to the care of the man who wields the sledge and does the heavy breathing for the establishment. This simple method of turning cone-shaped wheels may not be new to many, but yet I have seen it adopted only by a very few machinists. When the lathe has proper compound carriage movements and tool feed, this method is not needed, but such tools are like hen's teeth.

Wind-mill Economy.

At the recent meeting of the American Society of Mechanical Engineers, A. R. Wolff read a paper on wind-mills in which he gave tables of actual economy of wind-mills from 8½ to 25 feet diameter. His conclusion was that the wind-mill is the most economical prime mover for certain situations. The paper gave rise to the following discussion:

WM. J. ROOT: This subject is destined, in the future, to have a great deal of importance. The suggestion has been made to procure power by connecting wind mills with electric wires, and also by compressing air into pipes, and by connecting mills over a large tract of country, the loss from calms would be in a great measure neutralized, the wind blowing in one place while it was calm in another. It would only be a question of covering sufficient territory to procure a constant power. I think, in the future, that this subject is going to receive a great deal of attention, and that wind will be found to be one of the most valuable sources of power.

GEORGE S. STRONG: I have spent three or four years in experiments on the operation of wind-mills for farming and railroad purposes, and I think Mr. Wolff's tables are very moderate in their estimate of power. In regard to the operation of railroad water stations, which is one of the most useful applications of this prime mover, the first cost of a railroad water station, with steam power, with sufficient tankage, is in the neighborhood of $2,000, and the actual expense of running such a station is $1.50 a day for an engineer, which would amount to the neighborhood of $45 a month, in addition to which would be the cost of coal, the whole cost amounting to about $2,000. The first cost of putting up a water station with sufficient tankage to use a wind-mill (which requires about twice or three times the tankage that a steam pump requires), is $2,500—nearly the same as the first cost of a steam water station. The cost of running it is small; one man on the line of the road being able to attend to all the mills on the road. I have seen a place on the Camden and Amboy Railroad where they had kept a man constantly at work, and they put a pump and wind-mill there and the wind was very regular, and, although they used the whole amount of that tank every day, they run that mill a year without its being out of order.

The speaker went on to state that last summer he was in London and heard Sir William Thomson read a paper on the subject of wind-mills, and that he communicated with him afterwards, and that Mr. Thomson was surprised to learn that Americans had gone so far and done so much with wind-mills, whereas there had been practically nothing done in the matter on the other side. The speaker likewise stated that Sir William Thomson made the remark that he did not think a practical wind-mill had ever been invented.

Mr. Strong proceeded: The old-fashioned mill of four sails is used extensively all through Europe for pumping and grinding. I venture to say that one half the flour used throughout Europe is ground on those old-fashioned mills. I also had a talk with Mr. Berin, of the Brush Electric Light Company, of Cleveland, not long ago. He has given this subject considerable attention, and he thinks by the storage of electricity it might make a very effective prime mover.

Cast iron patterns should be made smooth and treated to a coat of beeswax before being used.

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NEW YORK, JUNE 3, 1882.

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Auxiliary Steam Power for Sailing Vessels.

A problem in steam engineering that is at present receiving considerable attention is the application of auxiliary steam power to sailing vessels. We noticed recently at a large engineering works in this city, that several engines were being constructed for this purpose, some of which we understand are for regular carrying vessels. The establishment referred to has done considerable business in similarly furnishing whaling vessels, and their success in this direction has doubtless had the effect to call the attention of owners to the presumed advantages of the plan, and the quiet but no less strong interest manifested is of considerable significance as possibly indicating a practical revolution in ocean transportation.

The first thought, when it is considered that the advantages of sails over steam are less first cost, less cost for propelling, and increased carrying capacity, is that the adoption of the plan indicated is the virtual abandonment of a natural and cheap power for an artificial and costly one. This, however, is not what is intended, as beyond reasonable question the force of the wind will continue to be the principal propelling force in navigation for many purposes, at least till artificial power is much less costly than at present. There are, however, good reasons for believing that the large sailing vessel of the future (and perhaps the smaller one too), will not be considered complete unless provided with moderate steam power.

With all the elements of economy in favor of the sailing vessel, there are always the elements of time and uncertainty against it, and these are of vastly greater importance in their effects than they were fifty years ago, and their relative importance may be expected to increase year by year. While the rapid transit of the steamship may not, in many instances, be of sufficient value to offset the increased cost, it would seem to be reasonable to suppose that, as between the swift and certain steamship, the carrying capacity of which for long voyages is greatly dimished by the weight of machinery and fuel, and the slow and uncertain sailing vessel, subjected to occasional vexatious delays, there is a position to be filled by the vessel depending mainly on sails, but carrying for use in emergencies small engine power and a limited supply of fuel.

The idea is by no means new, but, generally speaking, it has not received the attention absolutely necessary to success. The whole thing may appear simple enough, but in reality it is a subject that requires a particularly careful consideration, and an intimate knowledge of cause and effect in relation to every part of it. From the very nature of things, the construction must be simple, particularly so, as such vessels cannot, like large steamships, carry a corps of skilled engineers or mechanics. On the other hand, there must be an economical use of fuel, or the end will be defeated in the beginning. In fact, the whole problem of construction as to detail and arrangement, relative proportion of steam power, etc., etc., opens up a new branch of engineering.

The advantages of such a system are apparent enough. The ability to make reasonable progress, notwithstanding unfavorable winds, or to get out of calms and into winds, and the assistance and saving of time in getting out of and into port, all mean the tying up of a large capital a less time for the accomplishment of a certain end. To this may be added a frequent saving of expense in tug hire, and, probably, in emergencies, the saving of the vessel and cargo, as well as human life.

Against these advantages must, of course, be placed the increased first cost as well as the additional expense involved in operating the steam power, the whole problem involving not only the constructing and adaptation of the power to this specific purpose, but such an intimate acquaintance with everything pertaining to ocean transportation as to adapt the means to the end on a paying basis.

Spasmodic and unconsidered efforts will not succeed, neither is the problem to be solved in a day; but that the solution will eventually be complete to the working of an important commercial change, looks entirely reasonable, particularly so since engineers of well-known ability are giving the subject the benefit of their efforts in full belief of success.

The great progress that has, within the past few years, been made in the economy of the marine steam engine, has resulted in incalculable benefit to mankind. If another important advance is made in the direction indicated, the benefit will be equally widespread in its effect.

An Exposition in the Mining Regions.

Denver, Colorado, is to have a "National Mining and Industrial Exposition" beginning August 1st, and closing Sept. 30th. A building 500x316 feet estimated to cost $150,000, is to be erected and the greater part of the money has been subscribed by the citizens. One of the most prominent departments will be that of machinery. One of the directors, Hamilton S. Wicks, is visiting the manufacturers of machinery in New York and New England to secure their representation at the Exposition, and is succeeding very well. Several of the leading steam pump and mining machinery manufacturers have secured spaces, and many others are likely to do so. The rules are about the same as for other expositions. No charge is made for space. One very good feature, which indicates that the managers are progressive, is explained in the following paragraph which we copy from the pamphlet issued by them:

"The custom of awarding premiums has been so freely condemned that it has been omitted here. The action of ignorant or biased jurors will thus be avoided. Exhibitors will appreciate this feature, as it leaves them free to win success among the people, who will prove the claims of inventors by actual tests."

A Suggestion to Master Mechanics.

One of the most profitable means of information for master mechanics is a systematic method of catechising engineers.

There is no one better qualified to give reliable information in reference to the practical operation of a locomotive than the engineer; the man who runs it. This being true the master mechanic would derive great benefit from a proper examination of his engineers.

Such a course would result beneficially both to master mechanic and engineer.

Beneficially to the engineer, because catechising would instill into him the ability of using his thoughts, and in a short time develop in him the ability to explain matters concerning his engine, with which he may be familiar.

It is well known that some of the best practical engineers are men who, if put upon the witness stand to furnish evidence of their qualifications to handle steam machinery, would be utterly unable to pass such an examination, and from their answers to plain practical questions, a person would judge them to be entirely unqualified to act in the responsible capacity of engineers.

If a master mechanic who has never tried the experiment were to question his engineers, with a view to finding out their views in regard to wanting to know more about their engines, he would be surprised at the eager disposition manifested by the majority to learn and advance themselves in knowledge.

It is impossible for a master mechanic to learn from his own experience how a certain new kind of engine works, or what is the effect of some new device, or alteration in the dimensions of some particular part of the engine. Neither can he always rely upon the verdict given by the ordinary engineer, for the reason that he is too liable to be a little prejudiced either in favor of or against that particular device or arrangement. The plan that we would suggest is for the master mechanic at certain stated intervals, say once every week, to hold a conference with his engineers upon certain subjects connected with the running of their engines. These subjects should be taken up in a regular systematic order. For instance, pumps might be taken up at one time, injectors the next, then boilers, firing, packing, and so on. It is well known that all the engineers upon the road cannot be got together at one time, but a system could easily be arranged so as to give them all an equal chance.

"Hitherto the use of steel as a material for shipbuilding has been merely partial or occasional," says Consul Leonard, stationed at Leith, Scotland, "but there are now indications that, to a considerable extent, it will take the place of iron."

Literary Notes.

Calvert's Magazine, for May contains some interesting articles, among which we notice Tales told by an Idiot, Down by Thorlson's Dock, Mr. Froude's Life of Carlisle, The Academy of Design and Charles Lamb. There are also several poems. The departments of Art Notes and Random Thoughts are very entertaining. This magazine is in its fourth year and bears evidences of careful editorial work.

The St. Louis Illustrated Magazine for May continues its "Sketches of St. Louis," presenting many illustrations of buildings and objects of interest in that city. It also has several stories, fashion notes, and considerable miscellany.

The Apprentices' Journal is a new monthly publication, issued by Clarence D. Hotchkiss, Lansdale, Pa., at 50 cents a year. It contains articles of interest to apprentices and others.

We have received a copy of the Cornell University Register for 1881-82. The information contained in it is very complete. Three hundred and eighty-four students are attending the University, and it requires forty-four professors and assistant professors, besides a number of "instructors" and lecturers, to impart knowledge to the students. It is estimated to cost about $300 a year for a student to attend this institution, except to those who have State scholarships. The tuition is $75 a year, and a law of the State of New York permits one student to be appointed from each of the 128 Assembly districts to be instructed free. The selection must be by competitive examination. The machine shop, brass and iron foundry and blacksmith shop are fitted up with necessary tools, such as lathes, planers, grinding machinery, drilling machines, shaping machines, a universal milling machine, standard gauges, cupolas, testing machines, wooden models, drawing apparatus, &c., required to give practical mechanical instruction. Each student in the department of Mechanic Arts is required to devote two hours a day to work in the shop. They must each attend ten lectures or recitations a week or their equivalent, also practice drawing two hours a day. The Register shows that of 108 freshmen 14 are pursuing the course of Mechanic Arts, while only 7 of the 88 sophomores and 7 of the 71 juniors are counted in that department. Of the 59 seniors not one is accredited to the department of Mechanic Arts. This seems to indicate that while "many are called, but few are chosen" for graduation. Perhaps the popularity of wrestling with Greek roots is so much greater than that of manipulating shop tools that the student of mechanics becomes discouraged and yields to the ambition of college *eclat* by entering the so-called "literary" course. If so, he probably has opportunity to discover after graduation that what constitutes college honors has very little influence upon practical business affairs.

QUESTIONS & ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.

(179) E. H., Glen's Falls, N.Y., asks: How is the condensing water supplied to a jet condenser, especially on steamboats? *A.* It flows in from the effects of the atmospheric pressure, the air pump acting in respect to this the same as an ordinary pump acts in pumping water.

(180) X. Y. Z., Meadville, Pa., asks: 1. What diameter and weight should a band fly-wheel for a 12″×16″ engine be, engine to run at 160 revolutions, plain slide valve? *A.* Diameter, say 6 feet, weight 1,800 pounds. 2. Should the size be changed to run at 200 revolutions? *A.* The diameter may remain the same, but a weight of 1,450 pounds will answer.

(181) G. W. I., Worcester, Mass., asks: In which direction shall I run an emery wheel to grind a reamer round after hardening? *A.* In the opposite direction from that in which the reamer revolves, as you indicate in your sketch. 2. How shall I draw the form of cutters to cut the teeth of small gear wheels? *A.* See AMERICAN MACHINIST, of August 7, 14 and 21, 1880.

(182) F. A. B., Brantford, Canada, asks: How can I lay off a wrought iron crank to turn the wrist so as to be true with the other parts? *A.* It is better to make the centers in the arms which you use on the ends of the shaft to turn the wrist, before they are put on. You can easily make the centers in both arms exactly the same distance from the center of the main eye, by bolting to the face plate a washer, say 1″ thick, at the proper distance from the center; the diameter of this washer being such as to exactly fit the eye. Then by bolting the arm to the face plate over this washer you can drill and ream the centers in each arm. The body of the shaft being turned true and so that the arms will fit tightly, lay the crank on two parallel pieces on a face plate (a planer table for instance), block up the throw of the crank to the same height as the centers of the shaft and put on the arms with the crank pin centers the same height as the others. Use a surface gauge for setting.

(183) G. F., Greenwood, N. Y., asks: 1. Will you please tell me how you get the mean effective pressure in a cylinder as in your answer to F. W. S., Jan. 20? *A.* You will notice that the pressure as given in answer to his inquiry is only estimated. A well-constructed engine of the class described by him should be able to utilize that pressure, and in the absence of any knowledge of the matter we simply estimated the pressure, as we stated. You can only establish what the actual pressure in the cylinder of a steam engine is by the use of the indicator. 2. What is the power of a steam engine 8″×10″ running at 140 revolutions with 80 pounds steam? *A.* It should develop from 12 to 14 horse power.

BUSINESS SPECIALS.

Transient Advertisements, 50 cts. a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Thursday morning for the ensuing week's issue.

We receive numerous inquiries relating specially to matters of private interest. While desirous to oblige our friends, we would suggest, that an advertisement of two or three lines under this heading will usually develop the desired information easily and quickly.

Portable Forges, $10. Holt M'fg Co., Cleveland, O.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N.J.

James W. See, Consulting Engineer, Hamilton, O.

C. A. Seley, Consulting Engineer, St. Paul, Minn.

Presses and Dies. Ayar Mach. Works, Salem, N. J.

Latest and best books on Steam Engineering. Send stamp for Catalogue. F. Keppy, Bridgeport, Ct.

Foot Power Machinery, for workshop use, sent on trial if desired. W. F. & John Barnes, Rockford, Ill.

J. C. Hoadley, Engineer and Expert, 29 High St., cor. Federal, Boston, Mass.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Do you manufacture Hardware or House furnishing goods you wish sold in New York? If so, address Manufacturer's Agent, care of AM. MACHINIST.

Machinists' Bench Tools; largest stock in the United States. Send for Machinist Catalogue, 212 pages. Tallman & McFadden, 607 Market st., Philadelphia.

We want to buy a Gear Dressing Machine, either new or good second hand. Address, with full description and price. Great Western Manufacturing Co., Leavenworth, Kansas.

J. E. Kelley, New Haven, Conn., a roofer of long experience, writes to T. New, 32 John street, N. Y.: Your process for manufacturing Prepared Roofing is perfect, giving entire satisfaction.

Jas. F. Hotchkiss, 84 John St., N. Y.: Send me your *free* book entitled "How to Keep Boilers Clean," containing useful information for steam users and engineers. [Mention this paper.]

"Slide Valve Gears," by Hugo Bilgram, published by E. Claxton & Co., Phila., describes the easiest method known for correctly proportioning slide valves, link-motions and cut-off gears; price, $1.00.

Russell & Struthers, Wax Process for making outline engravings. Specimens each week in the AMERICAN MACHINIST. We also do Map Engraving with best facilities. Russell & Struthers, 59 Park Place, New York.

Steam Economy, by A. Wilkinson, M. E., No. 123 N. 4th street, Philadelphia, Pa. A new work on steam. Illustrated with numerous diagrams taken from engines in this country and in England. Points out and remedies defects in steam engines. Great variety of practical information for steam users. 124 pp., in cloth, $1.00 by mail.

If you desire to keep pace with the daily progress and development of Telephone, Telegraph and Electrical matters, have a copy of the NEW YORK REVIEW OF THE TELEGRAPH AND TELEPHONE sent to your address. Only $2.00 per annum. George Worthington, Editor and Proprietor, No. 23 Park Row, New York. P. O. Box 3329.

The Student's Illustrated Guide to Practical Draughting. Price, $1.00. Lectures in a Workshop, with an appendix containing famous papers by Sir Joseph Whitworth on "Plane Metallic Surfaces," "Uniform System of Screw Threads," etc. Price, $1.00. Either work sent on receipt of price on application to the author, T. P. Pemberton, 142 Greenwich Street (P. O. box 3083), New York.

Bound Volumes and Patent Binders. We can furnish Volume 3 of the AMERICAN MACHINIST, containing the full 52 issues of 1880, or Volume 4, containing the 53 issues of 1881, neatly bound in cloth, ready to ship by express, for four dollars. Either volume unbound, three dollars. "Patent Binder" for the AMERICAN MACHINIST holds 53 weekly issues in good shape. Sent to any address by mail for one dollar. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton Street, New York.

"Extracts from Chordal's Letters," the most interesting mechanical book published. A great variety of mechanical and business topics treated in a wise and witty way that will be instructive to old and young mechanics, and interesting to everybody. As many as 150 copies have been sold in a single shop. Over 40 Humorous illustrations; 320 pages, 12 mo. Price, $1.50 per copy, by mail, to any address. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton St., New York.

Important to Millwrights, Machinists and Pattern Makers—I have compiled a complete and absolutely correct table of The Diameters of Toothed Wheels on Pitch Line, by which any mechanic can instantly find what he requires or wants, without calculating. This table should be in the chest of every mechanic and millowner, and in the office of every manufacturer, as it saves hours of time, and dollars of money. No algebra to learn, no arithmetic to study. I have also added the computation table of what is known as the "Manchester Principle." Price, $2 per copy. Address, Wm. T. Ross, care Bremaker & Moore Paper Co., Louisville, Ky.

MANUFACTURES.

The Cleveland, Akron and Columbus Railroad shops are to be removed from Akron to Mt. Vernon, Ohio.

Ground has been broken at Lake View, near Chicago, Ills., for the erection of the Lassing Bridge works.

The Farrel Foundry & Machine Company, of Ansonia, Conn., are about to build an additional foundry.

The Illinois Central Railroad will soon commence the erection of its new shops at Burnside, near Pullman.

The Mansfield Elastic Frog Co., are about to build a large additional building to their factory in New Haven, Conn.

The Nonotuck Silk Co., Florence, Mass., have ordered a Korting Jet Condenser, to put on their Porter Allen engine.

The Hall Rubber Company of Boston, which owns $7,000 worth of land at Watertown, Mass., will build extensive works thereon.

A new saw mill is being erected at Milford, Conn. The saw mill of Cook & Son's at Kettletown, Conn., burned on Tuesday last, will be rebuilt.

The Howe Band Saw Filing and Setting Machine Company of St. Louis, is building a shop to enable it to supply the demand for automatic machines.

B. B. & R. Knight, Providence, R. I., are putting in a battery of Babcock & Wilcox's Sectional Boilers, which will be set with the Jarvis Patent Furnace.

A hundred thousand dollar company has been formed (over $80,000 already subscribed), to manufacture Gas Brackets, either in New Haven, or Wallingford, Conn.

The workshops of the N. Y., N. H. & H. Railroad at New Haven, Conn., are having an addition 160 feet long built to accommodate the increasing demand for working space.

The New Orleans & Pacific Railroad Company are building locomotive and car shops at Westwago, La, opposite New Orleans, where they will build and repair their own rolling stock.

There is some talk that Low & Watson, Boiler Makers, who were recently burned out at Bridgeport, Conn., will locate their new shops near Hopeville, Conn.

The Grand Central Hotel New York, and Oxnard's Sugar Refinery, Brooklyn, are having the "Mahoney Patent Furnace and Corrugated Grate Bars" applied to their boilers.

Over $200,000 has been subscribed for the new woolen mill at New Bedford, Mass., The land purchased for the site includes about 28 acres. The mill will employ from 225 to 250 hands.

The Moline, Ill., Malleable Iron Works, are building a large addition to their annealing room, and placing in four more double ovens, giving the works a capacity of 250 tons of finished castings a month.

Bridgeport, Conn., is to have another large Hat factory located within its borders.

The National Manufacturing Company, Nashville, Tenn., are setting two tubular boilers with the Jarvis furnace. This mill will manufacture a general line of cotton goods for the southern trade.

Frank Jones & Co., brewers, Portsmouth, N. H., are enlarging their brewery and putting in a new 6 foot tubular boiler, which will be set with the Jarvis furnace to burn their waste hops and cheap fuel.

Boyd, Corey & Co., shoe manufacturers, Marlboro, Mass., have purchased a new 75 horse power Brown engine. They have two boilers set with the Jarvis Furnace, and burn wet peat for fuel, that they dig in the rear of their shoe factory.

Preparations are rapidly making for building the new machine and repair shops for the European & North American Railway Company, at Mattawamkeag, Me. The building will be of brick, will be 134x60 feet, and will be about eighteen feet in height.

The Knowles Steam Pump Works will stay at Warren, Mass, the company having purchased of Asa Comins & Son, the house and land opposite the works. A large addition will probably be put up, or the Blake Pump Works of Boston may move to town.—*Worcester Spy.*

The Gaylord Foundry and the Cross & Speirs' Machine Works have amalgamated their interests, and will hereafter be known as the Gaylord, Cross & Spiers Company, Waterbury, Conn. They will make castings, small lathes, small upright drills, presses, etc.

Osborn & Cheesman, of Ansonia, Conn., are putting up large buildings at Shelton, where they have purchased water power, and property having 300 feet front on the river. Into these buildings they propose to remove part of their brass works from Ansonia.

The Oneida (N. Y.) Steam Engine and Foundry Company, write us: "Our business is good, orders for chucks two months ahead. Have lately increased our capacity by putting in nine new machines. We have hard work to get our supply of stock fast enough."

W. F. & F. C. Sayles, Pawtucket, R. I., have just reset two Corliss upright boilers with the Jarvis Patent Furnace. This is the fifth order they have given and they have now the Jarvis system in operation under tubular, Corliss and Babcock & Wilcox boilers.

The Stow Flexible Shaft Company, 1505 Penna. Ave., Philadelphia, have recently greatly enlarged the floor space occupied by their manufacturing department. Their export orders have greatly increased during the past year, forming a large proportion of their flourishing business.

Twenty years ago the Cleveland Rolling Mill Company employed 250 men in the manufacture of merchant iron and iron rails, while to-day 6,000 men are employed in the making of steel rails, steel wire, steel boiler plate, steel shovels and other products that were formerly made of iron.

E. Gould & Eberhardt, Newark, N. J., are pushed with orders for machine tools. They are employing 140 men. Among the new tools lately designed is a 40 inch drill, one of which was just sent to the Atlantic & Pacific Railroad shops. They are also making some engine lathes of new designs.

The new foundry and machine company which we mentioned last week as being about to be organized in Ansonia, Conn., has just been incorporated with Thos. Wallace as President. All the stock was taken up at the first meeting, and it is said twice as much more could have been placed.

John Keppelman, formerly president of the Union Foundry and Manufacturing Co., Reading, has purchased the property at the corner of Second and Court streets, of the same city, known as Robertson's Foundry, and intends running it as a general jobbing foundry, making a specialty of fine gray-iron castings.

Henry W. Bulkley, 149 Broadway, New York, has just placed two of his Condensers on the engines of the Washburn & Moen Wire Works, one on a 40″ engine at the Cambria Iron Works, one on a 42″ engine at the Phœnix Iron Works, three on engines of the Pennsylvania Steel Works and two on engines of the Rome Iron Works.

Ninety thousand pounds is the weight of a machine constructed by The Birmingham Foundry, of Birmingham, Conn., for the Cleveland Rubber Co. They have also been getting out such heavy work for the Trenton Rubber Co., that a special track had to be laid on the Derby Bridge to prevent the breakage of the planking of the bridge.

Work is progressing well on the new locomotive works at Rome, N. Y. The buildings are nearly finished and the machinery is being put in place. The buildings include a machine shop 80x270 feet, two stories high; blacksmith shop, 65x170 feet; boiler shop, 70x170 feet; foundry and pattern shop, 80x270 feet; engine house and some other buildings.

The Gardner Water Works, Gardner, Mass., constructed by the Wiley Construction Co., have completed their works, and the pump built by the Deane Steam Pump Co. is in position. The boilers are set with the Jarvis Patent Furnace, and cheap fuel will be used. The Binghamton Water Works are using this system, and pump 1,000,000 gallons one foot for 1 1-5 cents.

The construction and repair shops of the Derby Railroad at New Haven, Conn., have recently had additions of machinery and are now being provided with a new turn-table. They have just put up a six-ton crane at their Derby depot, in Derby.

J. F. Stauffer, Lancaster, Pa., is manufacturing a new steam pump adapted principally to feeding boilers of portable and traction steam engines, saw mills and for other like situations where a pump with few parts easy of access and withal cheap in price is desirable. The parts are made in duplicate so as to be interchangeable and the pump can be used either in a horizontal or vertical position.

The foundry and machine shops, formerly owned by the Delaware County Manufacturing Company, of Manchester, Iowa, have been purchased by Charles Paxson & Co., who will immediately put them in the best shape, which will take about 30 days. They will be called the Union Iron Works and will manufacture the celebrated Manchester scraper, besides doing a general foundry and repairing business.—*Industrial World.*

The Gendron Iron Wheel Co., Toledo, O., are soon to build a new factory, 60x100 feet, four stories and basement, which will increase their capacity to fully three times what it is at present. They will place in it from $15,000 to $20,000 worth of the most improved wood and iron working machinery, and, when completed, they will employ 100 men. It is expected the new works will be in running order by October 1st.—*Industrial World.*

The Dean Brothers' Steam Pump Works, Indianapolis, Ind., have just supplied the Du Pont Paper Mills, Louisville, Ky., with two large vertical pumps—capacity one million gallons in 24 hours—for supplying the mills with water. They have also put a large fire pump in the court house at Crawfordsville, Ind. Among other pumps recently furnished by them is one to the Sibley College of Mechanic Arts, Cornell University, which will be used for illustration and experiment.

The Valley Iron Works, Williamsport, Pa., write us: "We are enlarging our machine shops, building a brick addition 32x60 feet, two stories. We have also in course of erection a forging shop 25x30 feet. Never, since our establishment in business, have our prospects looked brighter. Our orders are principally for saw mill machinery, for we have had more than we have been able to which handle, thus necessitating enlargement. We have made some marked improvements in our circular saw mills and headblocks, and will shortly place them in the Southern market.

E. Smedley, for several years Master Mechanic of the C. M. & St. P. R. R. shops at Dubuque, Iowa, has resigned his position and is going into business for himself in that city. He has associated with him as partner, C. H. Meyer, a well-known railroad man of Dubuque. They are building a two-story brick structure for a machine shop 45x130 feet; also a brass foundry 25x50 feet, and will be known as the National Iron and Brass Works. They expect to have the shop running by the 1st of June, and intend to make a specialty of steam pumps and brass goods. They have some large orders already.

Dean Bros., Steam Pump Works, Indianapolis, Ind., write us: "We are building an addition to our machine shop 50x200 feet. It is being substantially built of brick with stone foundations, cut stone cornice and trimmed with cut stone. It will be finished and equipped in the best manner for making steam pumps and water-works machinery. An overhead traveler will be mounted, with a capacity for a maximum lift of five tons and capable of traversing the whole length of shop. On the floor will be tramways with cars for moving work from place to place. We are also building a two story building 30x30 for offices and drafting room, to be fitted up in best manner with fireproof vault for drawings and papers. We will also extend our foundry 40 feet, making it 40x100 feet. When these improvements are completed we will have the best steam pump shop in the country. We are obliged to make these improvements on account of the extension of our business.

Weeks & Halsey, Brooklyn, N. Y., are about shipping machinery to Stockholm, Sweden, consisting of one of Johnson's hydro-pneumatic elevators with the necessary accumulator, compressor and other iron work. This elevator, which, with some improvements is the same as illustrated in our issue of Aug. 14, 1880, is to be used for the purpose of transferring passengers, merchandise, etc., from one of the two plateaus on which the city of Stockholm is built to the other,—a vertical distance of 140 feet. The air compressor constructed for use with the elevator, is of entirely new design, and is possessed of some special features to enable it to work satisfactory in connection with the peculiar economical construction of the elevator, viz.: that by which it uses the air continuously instead of discharging it into the atmosphere at a reduced pressure after it has done its work. The general features of the compressor are two inclined steam cylinders situated at the base of a triangular vertical housing, and connecting with a crank-shaft at the apex. Two fly-crank wheels connect with two single-acting water-jacketed air cylinders, situated on the bed plate at the bottom and sides of the housing. The diameter of all cylinders—steam and water—is 12″ with a stroke of 14″. The compliment was paid the inventor and the firm of Weeks & Halsey, of selecting this machinery after extended investigation by Swedish engineers. Mr. Johnson will leave for Stockholm in a few days to superintend its erection. Messrs. Weeks & Halsey are doing considerable business in building their improved horizontal cut-off engine.

Machinists' and Engineers' Supplies.

NEW YORK, May 18, 1882.

There has been little or no change in the supply market since our last report. Orders continue to come in slowly and the dealers begin to look with serious apprehension upon the enormous production of the last six months, and their confidence is thereby weakened. The manufacturers continue busy and hold their prices firmly.

Wrought Iron pipe is the same as last week at a discount of 65 per cent. to 70 per cent from list.

Iron and Metal Review.

Owing to over-production and labor troubles the demand for Pig Iron continues slow and prices are weakening. We quote: Foundry No. 1 at $24.50 to $25.50; Grey Forge $21 to $22.50. Foreign Iron dull at $26 for Gartsherrie; Coltness, $25 to $25.50; Summerlee, $25; Cambroe, $23 to $24.50; Glengarnock, $24 to $24.50; Eglinton, $22.50 to $23. Copper dull at 18¾c. for Lake Superior. Other metals unchanged.

WANTED

"Situation and Help" Advertisements, 30 cents a line, each insertion. About seven words make a line. Copy should be sent to reach us not later than Thursday morning for the ensuing week's issue.

Wanted—Five good moulders and five good core makers. Address, Holyoke Machine Co., Holyoke, Mass.

Wanted—By a young man a position as foreman and draughtsman, now occupying a similar position. Address Comadore, care AMERICAN MACHINIST.

Wanted—A moulder competent to take charge of small foundry and make it pay. Address, with full particulars, BOX 2, AMERICAN MACHINIST office.

Wanted—An agent to sell a first-class steam engine; must be competent to advise customers on engineering questions. Address, R., office AMERICAN MACHINIST.

Wanted—A good boiler maker to do general work on new boilers and repair old boilers. A steady job to a good, steady man. Address, stating age, kind of work can do, and wages, Geo. R. Lombard & Co., Augusta, Ga.

Wanted.—An experienced Traveling Man in the Injector business. One who thoroughly understands the trade, both practically and as a salesman. Give references and salary expected. Address, A. B., care AMERICAN MACHINIST

Wanted—By a Draughtsman and Machinist, experienced in special and automatic machinery, also tools, fixtures and working up new ideas. References given. Address, F., 68 Howe street, New Haven, Conn.

Wanted—Working foreman for finishing shop. Architectural Iron Works. Competent to lay out, and build iron stairs, railing, grating, shutters, window guards, jail work, etc. Address, with references, N. S. Bouton, Cor. 15th and Dearborn sts., Chicago.

Wanted—A Party with good mechanical knowledge, of pleasant address and competent for salesman of machinery. With the proper party a liberal arrangement will be made. Address, at office AMERICAN MACHINIST, Burton, stating with what special machinery applicant is most familiar.

Correspondence is respectfully solicited by an intelligent industrious young man aged 22, thoroughly experienced in the clerical duties of a machine shop and general machinery house. Undoubted credentials. Address, Clerk, AMERICAN MACHINIST office.

A man 31 years of age desires a situation in a machine shop as superintendent or foreman. 13 years' experience as apprentice, journeyman, toolmaker, draughtsman and foreman in Illinois, Iowa, Minnesota, Nebraska, Kansas and Missouri. Correspondence invited from parties who mean business. J. E. McConnell, Iowa City, Iowa

Wanted—Two first-class engine blacksmiths, of sober, steady and industrious habits can find employment of a permanent character at Morgan, Williams & Co., Alliance, O., married men preferred. The surrounding country is of the most pleasant and healthy, the class of work the best, the workshop has steam hammers of the best and most modern design, no other than the class of men specified need apply.

For Sale—One first-class Iron Planer 16 feet long, 60 inches wide; extra heavy, reliable tool. S. L. Holt & Co., 67 Sudbury street, Boston, Mass.

Wanted—To purchase a Hewes & Philips Gear Cutter—second hand. Address, giving price and other particulars, Campbell, P. O. Box 2101, New York.

For Sale—An I. P. Morris Engine, sixteen (16″) by thirty-six inches (36″) cylinder, with governor. Also a fly wheel fourteen feet (14′) diameter and twenty inches (20″) face. Can be seen at works of Wm. Sellers & Co., Philadelphia.

For Sale—A 60 lb. Bradley Cushioned Hammer, entirely new and perfect, at a bargain. Address Lock Box 160, East Hampton, Conn.

The Second Grand Exhibition Fair

OF THE

New England Manufacturers' and Mechanics' Institute

Will be held in THEIR MAMMOTH EXHIBITION BUILDING, (the Largest in the United States),

In Boston during the months of September & October, 1882.

Affording the best opportunity for advertising, or of introducing to the public new inventions. Artists, Inventors, Producers, Mechanics and Manufacturers, from every nation, invited to contribute. The product of New England's hand and brain will be well represented. No charge for space. Blank forms for application to exhibit furnished free, upon application to

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38 Hawley Street, BOSTON, MASS.

COOKE & CO., FORMERLY COOKE & BEGGS,

Dealers in MACHINERY AND SUPPLIES.
6 Cortlandt Street, New York.
AGENTS FOR

The Waters Perfect Governor,

Having Adjustable Speed, Automatic Safety Stop, Sawyer's Lever, and Solid Composition Valves and Seats.

ALSO,

SUPPLIES

For Machinists, Railways, Mills, Mines, &c.

Please send for circular and state that you saw the advertisement in this paper.

REMOVAL,

New York, May 1st, 1882.

E. & F. N. SPON, Publishers and Importers of Scientific Books, beg to notify their customers and and friends, that they have removed to 44 Murray street, one block from City Hall.

SHEPARD'S CELEBRATED $60 Screw Cutting Foot Lathe.

Foot and Power Lathes, Drill Presses, Scrolls, Saw Attachments, Chucks, Mandrels, Twist Drills, Dogs, Calipers, "Sun Light" Gas Machines, etc. Send for catalogue of outfits for amateurs or artisans. Address

H. L. SHEPARD & CO.,
341 & 343 WEST FRONT STREET,
CINCINNATI, OHIO.

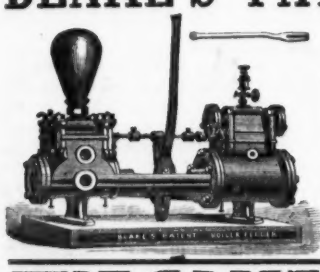
Holland & Thompson,

Troy, N. Y.
Manufacturers of the
HOLLAND
LUBRICATOR

For lubricating the valves & cylinders of steam engines. Operating with **downward visible drop.** The Principle of this Lubricator is entirely new; being the only one manufactured operating with a downward visible drop, and does not conflict with any other Patented Lubricator. Protected with Letters Patent, granted July 5, 1881. ☞ A saving of from 50 to 90 per cent. in cost of oils.

For Sale by
H. PRENTISS & CO.,
42 Dey St., New York.

BLAKE'S PATENT STEAM PUMPS.



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Adapted to Every Situation.

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THE CAMERON STEAM PUMP.

Is the Standard of Excellence

AT HOME AND ABROAD.

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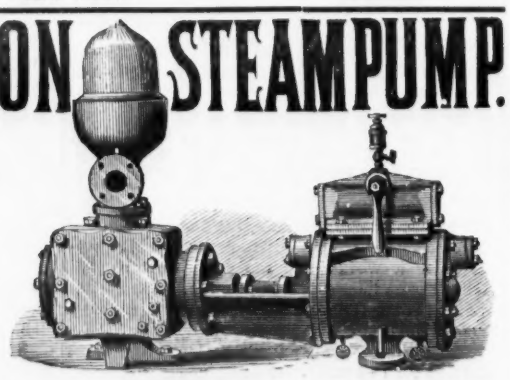

E. E. CARVIN & CO.

MANUFACTURERS OF
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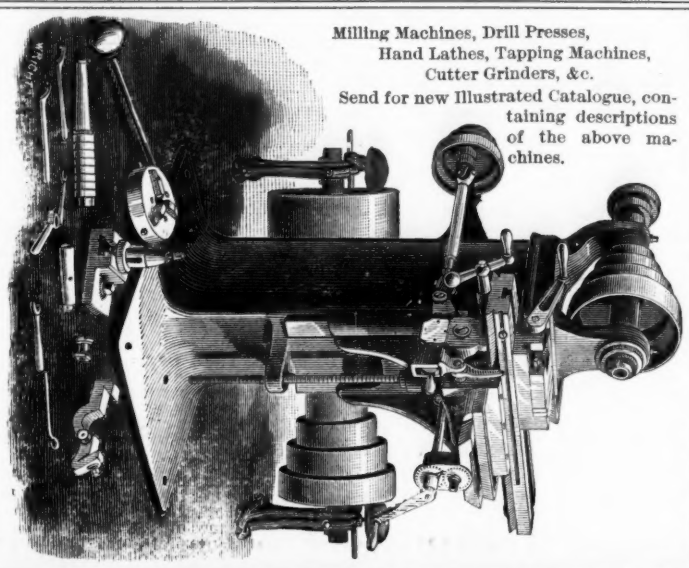
Milling Machines, Drill Presses, Hand Lathes, Tapping Machines, Cutter Grinders, &c.

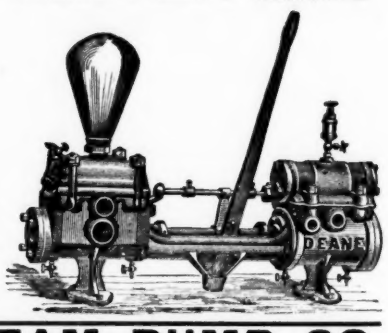
Send for new Illustrated Catalogue, containing descriptions of the above machines.



No. 2 Power Milling Machine. Price, as shown in cut, $400.00.

Office and Works, **139-143 Centre St., New York.**

"THE DEANE" STEAM PUMPS FOR EVERY SERVICE.



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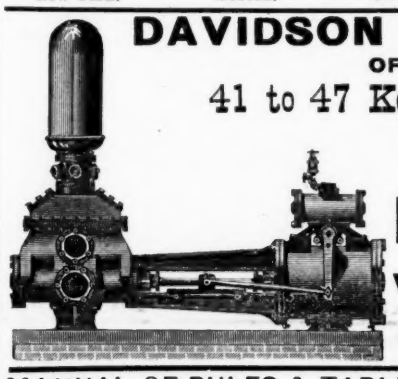
—:o:—

The Deane Steam Pump Co.
HOLYOKE, MASS.

92 & 94 Liberty St., New York. 54 Oliver St. Boston. 226 & 228 Lake St., Chicago.

DAVIDSON STEAM PUMP CO.

OFFICE AND WORKS:
41 to 47 Keap Street, Brooklyn, N. Y.
MANUFACTURERS OF
THE M. T. DAVIDSON
Improved Steam Pump.



Warranted the Best Pump Made for all Situations.

KELLY & LUDWIG, Agents, 49 and 51 North 7th St., Phila., 97 Liberty St. New York.

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By D. K. CLARK.
Second edition. Thick 8vo. 984 pages. $7.50.
D. VAN NOSTRAND,
23 Murray St. & 27 Warren St., N. Y.

CHARLES MURRAY,
Engraver on Wood,
58 ANN ST. NEW YORK.

BRADLEY'S CUSHIONED HAMMER

BRADLEY & COMPANY SYRACUSE, N. Y.

DRAUGHTSMAN ADJUSTIBLE T SQUARE

HARDENED STEEL	BLADE
24 IN. BLADE	$ 5.00.
36 IN. "	$ 7.00.
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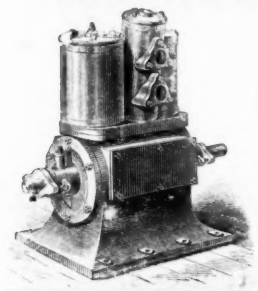

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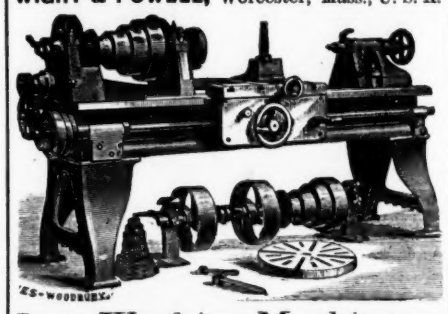

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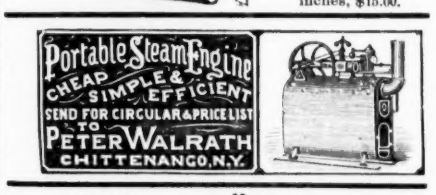

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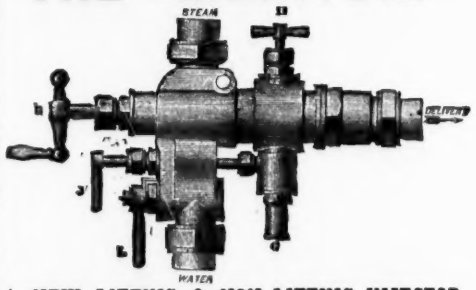

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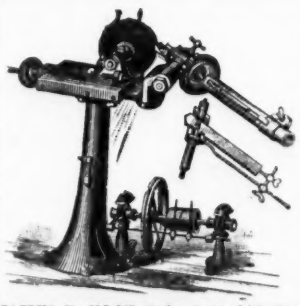

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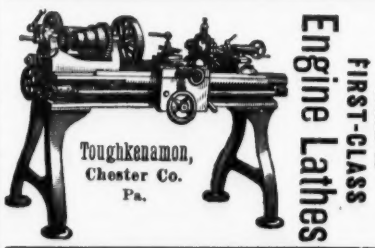

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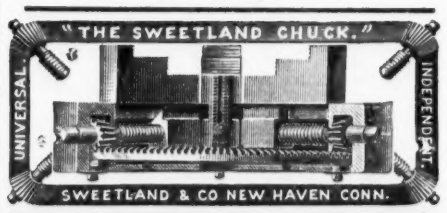

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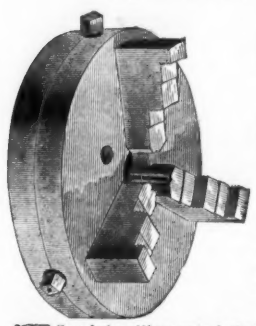

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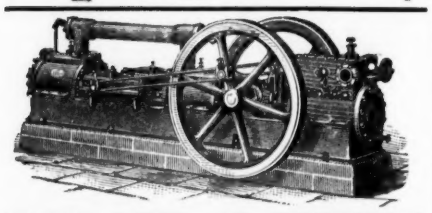

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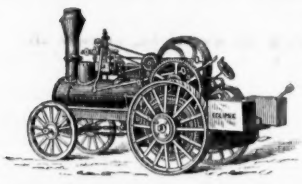

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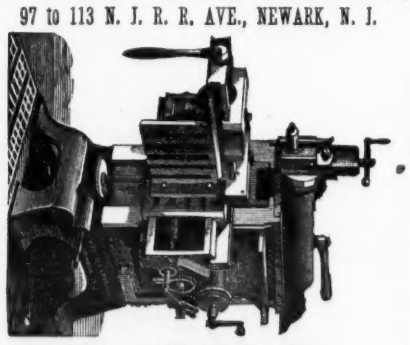

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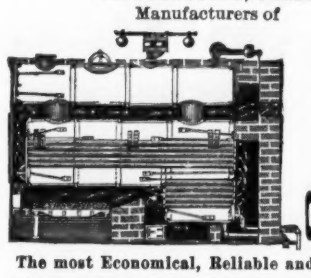

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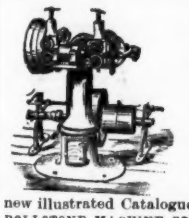

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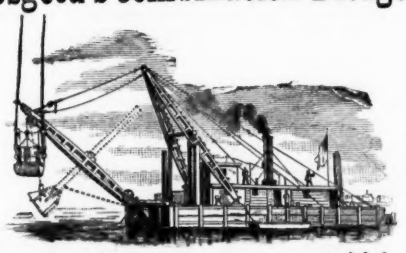

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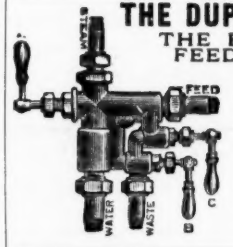

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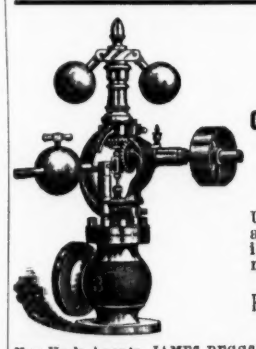

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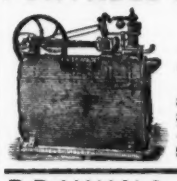

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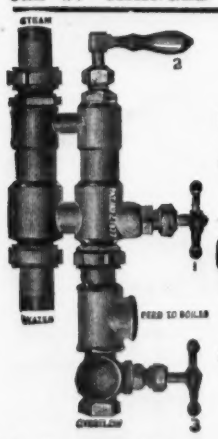

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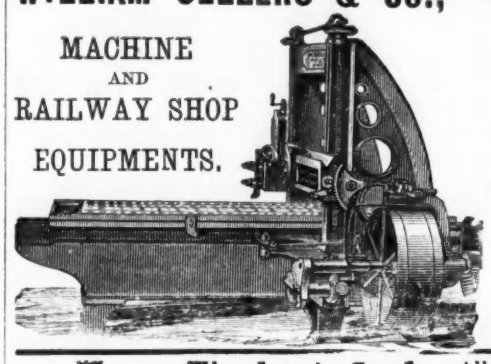

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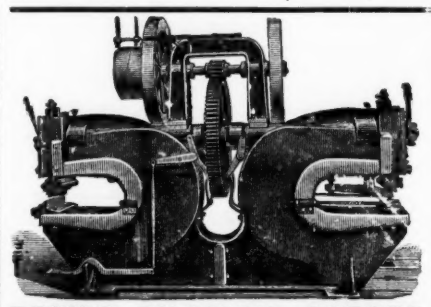

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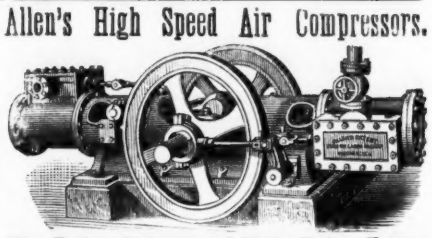

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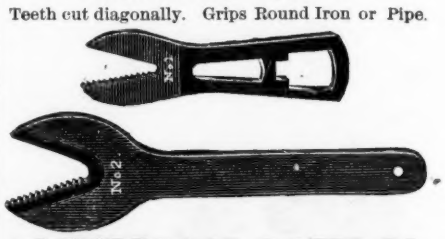

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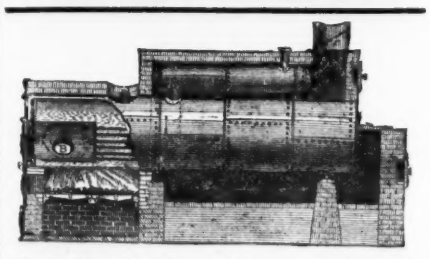

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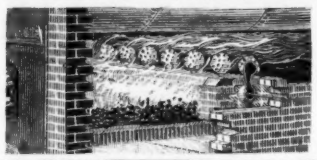

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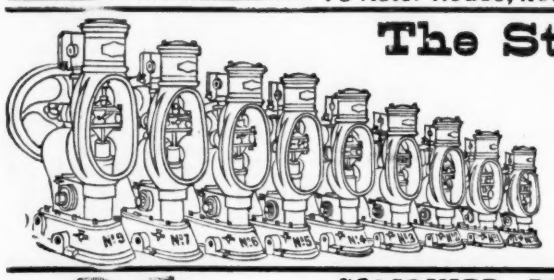

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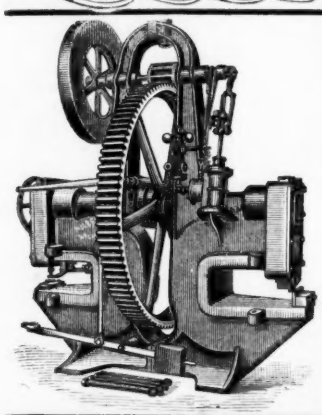

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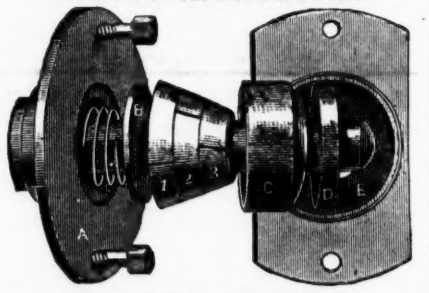

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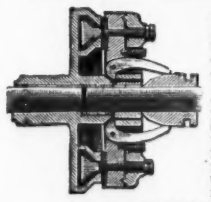

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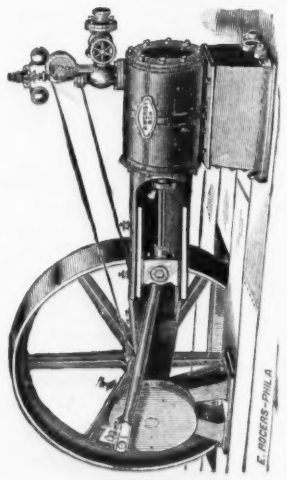

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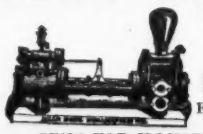

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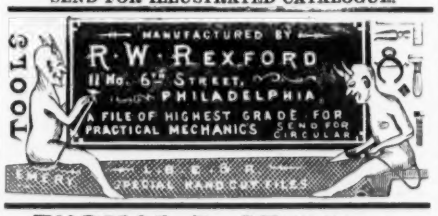

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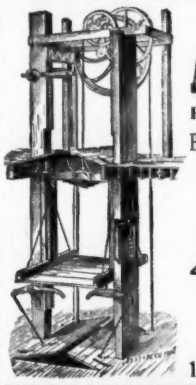

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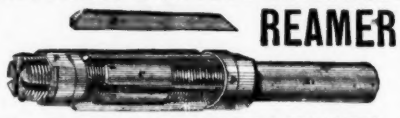

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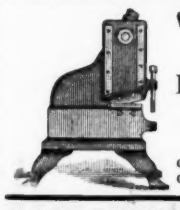

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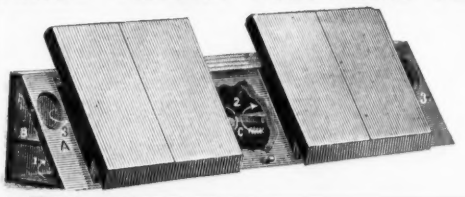

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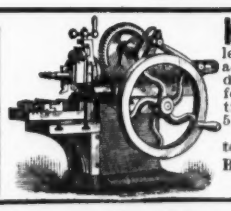

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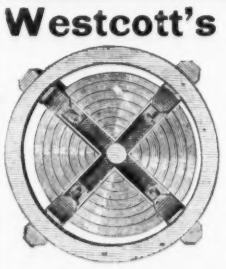

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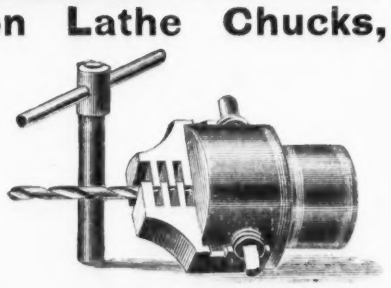

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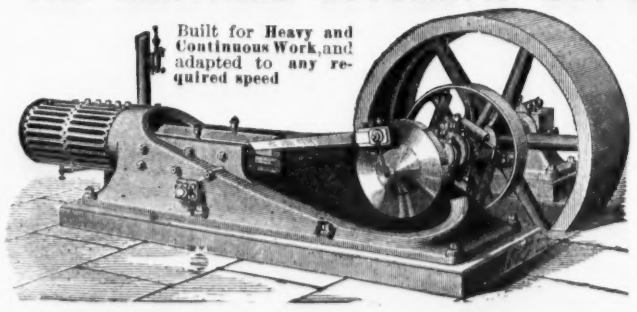

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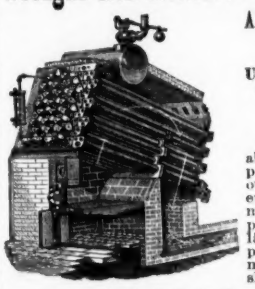

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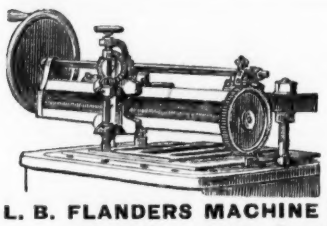

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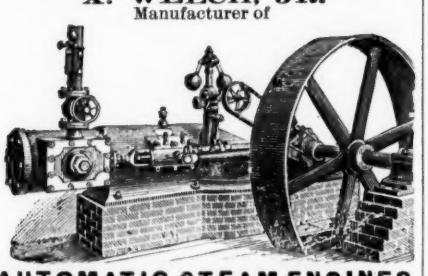

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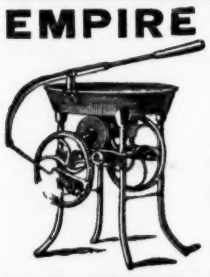

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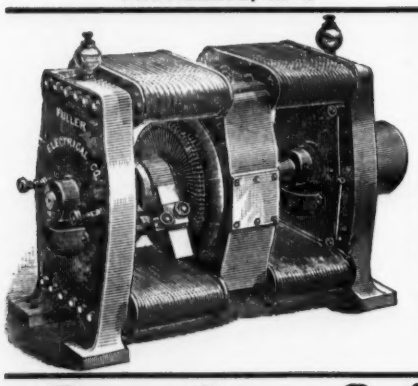

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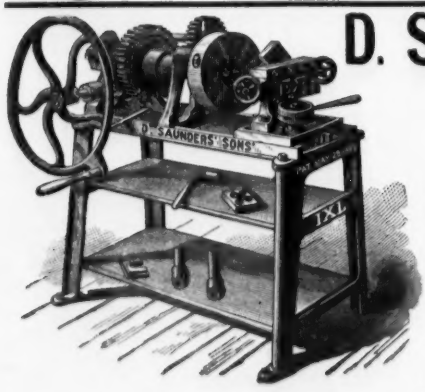

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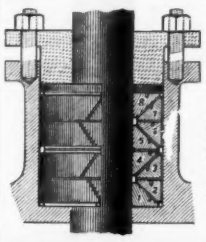

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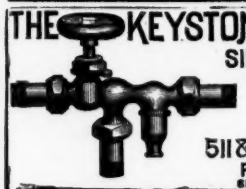

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Sole Agent for the U. S. and Canada.

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RUFFNER & DUNN,
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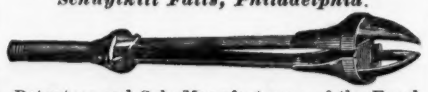

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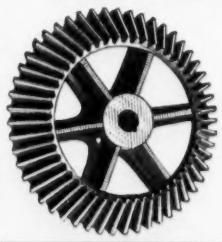
In great variety of sizes. Castings or finished work furnished the trade at favorable prices.



ALSO,
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Water Wheels.
POOLE & HUNT,
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938 to 954 RIVER ST.,
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VALVES—Double and Single Gate, 1-2 in. to 48 in. outside and inside Screws, Indicator, etc., for Gas, Water and Steam.
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FIRE HYDRANTS.
SEND FOR CIRCULAR.

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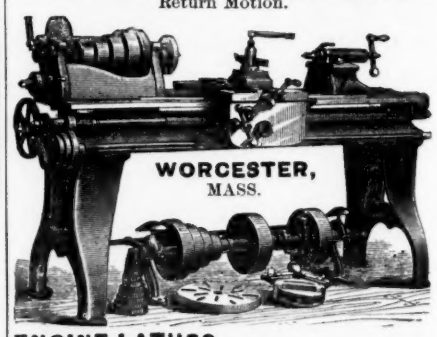
MACHINISTS' TOOLS.
IMPROVED UPRIGHT DRILLS, with Lever Feed, and Wheel Feed with Quick Return Motion.



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ENGINE LATHES,
HAND LATHES,
SLIDE RESTS, and
PLANER CENTERS.

ALMOND DRILL CHUCK.

Made of Steel throughout, and equal to doing any work required of it. Runs perfectly true. Sold at all Machinists' Supply Stores.
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HEWES & PHILLIPS' IRON WORKS,
NEWARK, N. J., Manufacturers of
Planers, Gear Cutters, Shapers, Slotters,
HYDRAULIC OIL PRESSES, AND SUGAR ESTATE MACHINERY, SHAFTING AND GEARING.
HEAVY PLANERS A SPECIALITY.
One 10 in. Slotter in Stock.
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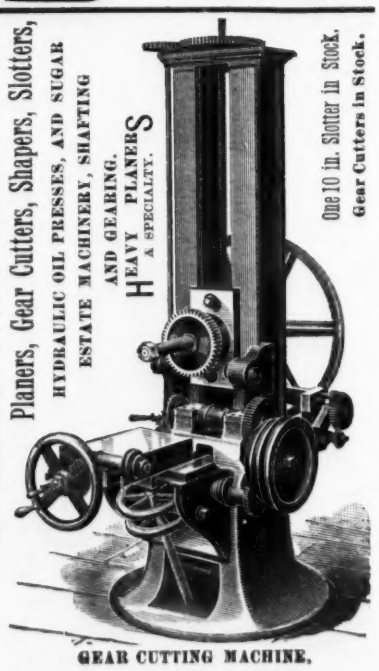

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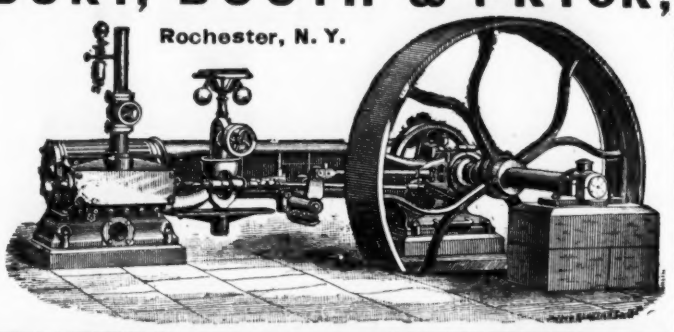
WOODBURY, BOOTH & PRYOR,

Manufacturers of

Automatic Cut-Off,
Fixed Cut-Off,
and Slide Valve
STEAM ENGINES,
Tubular Boilers.

Rochester, N. Y.



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Manufacturers of

The ALLEN PATENT HIGH-SPEED ENGINE.

Both Condensing and Non-Condensing, especially designed and constructed for the Rolling and Cotton Mill Trade, and all establishments requiring an absolutely uniform and economical power.

Tubular Boilers and Steam Fittings. Contracts taken for complete Motive Power Outfits.

JOSEPH B. MATTHEWS, 41 Center Market Space, Baltimore, Md

Manufacturer of the MATTHEWS

AUTOMATIC HIGH-SPEED ENGINE.

For Electric Lights and other purposes requiring steady, reliable power. The best and cheapest in the market. 25 H. P. for $500. Send for Circular.

KELLY & LUDWIG 49 & 51 N. SEVENTH ST. PHILADELPHIA, Pa.

NEW IRON WORKING MACHINERY On Hand or for Quick Delivery.

Write for prices and particulars.

ENGINE LATHES.

38 inch, triple-geared (bed to suit).		Fitchburg.
22 inch swing,	14 foot bed.	Fitchburg.
21 " "	14 "	Blaisdell.
20 " "	14 "	Fitchburg.
20 " "	12 and 14 "	Fifield.
19 " "	12 "	Gray.
19 " "	10 "	Gray.
17 " "	6 "	Johnson.
16 " "	6 "	Fitchburg.
16 " "	10 "	Blair.
16 " "	8 "	Fitchburg.
14 " "	6 "	Hand.
14 " "	6 and 8 "	Fitchburg.
13 " "	8 "	Blaisdell.

PLANERS AND SHAPERS.

30 inch x 30 inch x 8 foot,	Fitchburg.
18 inch x 18 inch x 4 foot,	Gould.
25 inch x 25 inch x 8 foot,	Fitchburg.
30 inch x 30 inch x 10 foot,	Hewes & Phillips
30 inch x 30 inch x 6 foot, (English make.)	
12 inch stroke shaper,	Fitchburg.
10 inch stroke shaper,	Fitchburg.

DRILL PRESSES.

60 inch radial drill, double-geared, self-feed, planed and slotted bed-plate with portable table. Best English make. Weight 4 tons.

48 inch radial drill, self-feed, double gearing slotted and planed bed. Betts.

30 inch, back-geared, automatic. Prentice.

25 inch, back-geared, self-feed, Fitchburg.

18 inch swing, back-geared, Fitchburg.

18 inch swing. Reed.

17 inch swing. Blaisdell.

New and Second-Hand Iron Working MACHINERY.

Two Engine Lathes, 42 in. x 16 ft. Triple Geared. Ames. New. June 1.
One Engine Lathe, 36 in. x 18 ft. Fifield. New. Aug. 1
One " " 28 in. x 17 ft. " " "
One " " 28 in. x 21 ft. " " "
Six " " 24 in. x 12 ft. " " July 1
One " " 24 in. x 10 ft. " " " 1
Two " " Each 24 in. 8ft. x10ft.-12ft.-14 ft. New. Ames.
Three Engine Lathes, 20 in. x 12 ft. Ames. New.
Three " " 20 in. x 10 ft. " "
Three " " 20 in. x 8 ft. " "
One " " 18 in. x 8 ft. Jones & Lamson. New.
Two Engine Lathes, 18 in. x 7 ft. Armsley & Harrington. Good order.
One Engine Lathe, 18 in. x 7 ft. Thayer & Houghton. Good order.
One Engine Lathe, 16 in. x 6-7-8 ft. Bridgeport Mch. Tool Works. New.
Six Engine Lathes, 16 in. x 6 ft.-7ft. x 8 ft. Ames. New.
Two " " 15 in. x 6 ft. Jones & Lamson. New.
One " " 15 in. x 6 ft. Fiather's. New.
One " " 15 in. x 6 ft. with Turret. Flathers New.
Two Engine Lathes, 14 in. x 6 ft. Star Tool Co. New.
Three " " 14 in. x 6 ft. Jones & Lamson. New.
Six " " 13 in. x 6 ft. Ames. New.
Two " " 13 ft. x 5ft. " "
Six Hand Lathes. 12 in. x 5 ft. Hendey. New.
Six " 10 in. x 4 ft. Prentice.
One Crank Planer, 12 in. Belden. New.
One Planer 24 in. x 5 ft. New Haven. Good order.
Three " 24 in. x 6 ft. Ames. New.
One " 26 in. x 8 ft. Hendey.
One " 30 in. x 8 ft. Fitchburg. New.
One " 37 in. x 10 ft. Second-hand. Good order.
Two 9 in. Stroke Shapers. Hewes & Phillips.
One 10 in. Stroke Shaper. Pratt & Whitney.
One 15 in. Stroke Shaper. Hendey. New.
One 10 inch Stroke Shaper. Gould & Eberhardt. New.
One 20 in. Stroke Shaper. G. & E. New.
One 24 in. Stroke Shaper. Hendey. New.
One Screw Machine. New Pattern. Wire Feed.
Three 4 Spindle Drills. No. 2. Pratt & Whitney.
One 6 " " " 1. " "
Four 16 in. Upright Drills. Prentiss. New.
One 24 in. Upright Drill. Ames. New.
One 30 in. " " Prentiss. New.
One 38 in. " " New Haven. New.
Three Sensitive Drills.
3 No. 2 Profiling Machines. Pratt & Whitney.
One Die Sinker. Pratt & Whitney.
20 Lincoln Millers and Vises. Good order.
8 Lincoln Millers and Vises. Pratt & Whitney.
One No. 3 Garvin Hand Miller. New.
One 10 lb. Air Hammer. Hotchkiss. Good order.
One 200 lb. Bradley Hammer. A1.
One 60 lb. Bradley Hammer. New.
Two 400 lbs. Drop Hammers. Merrill.
All sizes Bradley Hammers furnished to order promptly

E. P. Bullard, 14 Dey Street, New York.

General Eastern Agent for

AKRON IRON CO'S Patent Hot Polished SHAFTING.

New and Second-hand Machinery.

MAY 16, 1882.

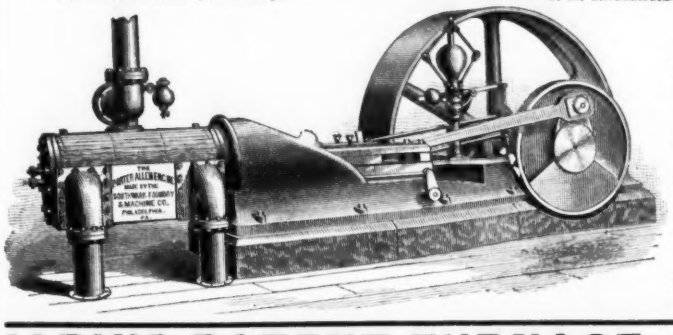
1 Engine Lathe, 14 in. x 6 ft. Grant & Bogert. New.
1 " " 22 in. x 10.12 ft. " "
1 " " 14 in. x 6 ft. Star Tool Co. "
1 " " 16 in. x 6, 7 & 8 ft. Bridgeport. "
1 " " 16 in. x 7 ft. Ames. "
1 " " 18 in. x 8 ft. Lodge & Barker. "
1 " " 24 in. x 12 ft. Fifield. "
1 " " 22 in. x 10 ft. " "
1 " " 26 in. x 12 ft. Lathe & Morse. "
1 Plain Engine Lathe, 15 in. x 4 ft. "
1 Engine Lathe, 30 in. x 16 ft. Perkins. "
1 " " 16 in. x 6 ft. " "
1 " " 24 in. x 12 ft. Michel. "
1 " " 12 in. x 5 ft. Prentiss. "
1 " " 12 in. x 4 ft. " "
1 Fox " 15 in. x 5 ft. Pike & Dean. "
1 15 in. x 4 ft. Turret Lathe. Lodge & Barker.
1 Planer, 24 in. x 24 in. x 6 ft. Woodman. "
1 " 16 in. x 16 in. x 3 ft. "
1 " 28 in. x 28 in. x 6 ft. In good order.
1 " 24 in. x 24 in. x 5½ ft. "
1 Upright Drill, 16 in. Prentiss. New.
1 20 in. Upright Drill. " "
1 30 in. " " " "
1 10 in. Shaper. Gould. New.
3 Pratt & Whitney No. 1 Screw Machines. "
1 Universal Tool Grinder. Slate.
1 Schlenker Bolt Cutter to take sizes from ¼ to 1¼ inches inclusive. New.

NEW YORK AGENCY OF THE TANITE CO., AND GRANT & BOGERT MACHINE TOOL WORKS:

H. PRENTISS & COMPANY,
42 DEY STREET, NEW YORK.

THE PORTER-ALLEN HIGH SPEED ENGINE.

W. H. MERRICK, President and Treas.
G. A. BOSTWICK, Secretary.
C. T. PORTER, Vice-President.
C. B. RICHARDS, Superintendent.

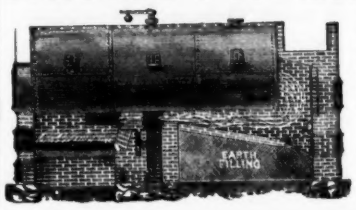


THE SOUTHWARK FOUNDRY & MACHINE CO., Philada., having largely increased its facilities is now prepared to fill all orders for the Porter-Allen Engine on contract time.

Orders solicited for Iron and Brass Castings in the rough.

Address the Company, 430 Washington Avenue, Phila., Pa.

JARVIS PATENT FURNACE FOR SETTING STEAM BOILERS.



Economy of Fuel, with increased capacity of steam power. The same principle as the SIEMANS' PROCESS OF MAKING STEEL, utilizes the waste gases with hot air on top of the fire. Will burn all kinds of Waste Fuel without a blast, including screenings, wet peat, wet hops, sawdust, logwood chips, slack coal, &c. **A. F. UPTON, General Agent,**

Send for circular. 7 Oliver St. (P. O. Box 3401,) Boston, Mass.

BERTON & NICKEL, New York Agents,
No. 92 Liberty Street.
POND ENGINEERING CO., Western Agents,
70 Market Street, St. Louis,
And 130 W. Second St., Cincinnati, Ohio.

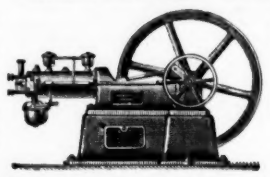
NEW OTTO SILENT GAS ENGINE.

Working without Boiler, Steam, Coal, Ashes or Attendance.

Started Instantly by a Match, it gives full power immediately.

When Stopped, all Expense Ceases.

No explosions; No Fires nor Cinders; No Gauges; No Pumps; No Engineer or other attendant while running.



Unsurpassed in every respect for Hoisting in Warehouses, Printing, Ventilating, Running small Shops, etc. 2, 4 and 7 H. P. and upwards.

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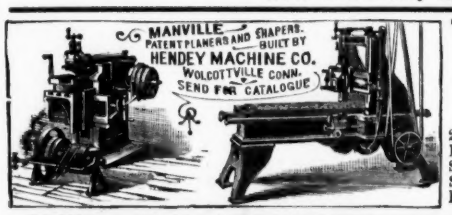


The Hendey Machine Co.

TORRINGTON, CONN., U. S. A.

Manville Patent Iron Planers and Shapers.

15 in. Shapers, 24 in. Shapers, 3½ ft. x 16 in., 5 ft. x 20 in., 6 ft. x 24 in., 8 ft. x 24 in. Planers, Amateurs' Hand Planers, with chuck and centers, Hollow Steel Spindle Hand Lathes, Brass and Wire Slitters, Spring Chuck, and Common Clock Lathes. Catalogue gives many names of users of our tools.

MECHANICAL DRAWINGS.

Copies or Tracings of any class of machinery made and used in Europe. 2000 designs. **WOOD & RICHMOND,** Mechanical Engineers and Draughtsmen, 176 Broadway, N. Y.

LARGE IRON PLANER FOR SALE.

Full capacity of Planer, 16' long, 36" wide, 36" high. A modern tool and in first-class condition.

S. T. LUND,
71 OLIVER STREET, BOSTON, Mass.

IRON PLANERS,
DRILLING MACHINES,
ENGINE LATHES,
IRON SHAPERS,
ENGINES & BOILERS

A GENERAL LINE OF

IRON AND WOOD WORKING

MACHINERY.

TOOLS & SUPPLIES

In Store and to Arrive.

O. L. PACKARD,

Milwaukee, Wisconsin.

HILL, CLARKE & CO.,

36 OLIVER STREET, BOSTON, MASS., and 800 NORTH SECOND STREET, ST. LOUIS.

IRON WORKING MACHINERY.

List of Tools for Quick Delivery Furnished on Application.

LATHES.

16 in. swing,	6 ft. bed.	Ames.	(on hand.)
16 " "	6 " "	Nutter. Barnes.	
19 " "	8 " "	Gray.	(on hand.)
20 " "	10 " "	Fifield.	On hand.
20 " "	14 " "	Fitchburg.	"
21 " "	12 " "	Blaisdell.	"
26 " "	12 " "	Powell.	
26 " "	16 " "	"	
36 " "	16 " "	Fitchburg.	(on hand.)
36 " "	18 " "	"	"

PLANERS.

16 in. x 16 in. x 3½ ft.	Parker.
22 in. x 20 in. x 4 ft.	Wheeler.
22 in. x 20 in. x 4 ft.	Ames.
22 in. x 22 in. x 6 ft.	Powell.
24 in. x 24 in. x 6 ft.	Ames.
24 in. x 24 in. x 6 ft.	Hendey.
27 in. x 27 in. x 7 ft.	Ames.
30 in. x 30 in. x 8 ft.	Fitchburg.
32 in. x 32 in. x 10 ft.	Gleason.
38 in. x 36 in. x 10 ft.	New Haven.

2 No. 2 Cabinet Turret Brass Lathes on hand.

SEND FOR ILLUSTRATED CATALOGUE OF MACHINE TOOLS.

Second-Hand & New MACHINERY.

May 17, 1882.

The following New and Improved Machinists Tools are part of what we have for early delivery.

1 30 in. x 30 in. x 8 ft. Planer. New. May.
1 42 in. Swing, 16 ft. bed. New Engine Lathe. June.
1 42 in. " 20 ft. " " " " "
1 36 in. " 12 ft. " " " " "
1 36 in. " 18 ft. " " " " "
2 30 in. swing, 15 ft. bed. Engine Lathes. May.
1 22 in. swing, 13½ ft. Bed Engine Lathes. "
5 22 in. x 12 ft. Engine Lathes. May.
3 19 in. swing, 10 ft. Bed Engine Lathes. May.
2 11 in. " 5 ft. " " "
2 30 in. " Upright Back Geared Drills. "
2 9 in. Shapers. New. May.
1 11 in. Shaper, 25 in. Traverse. May.

The following on hand:

1 26 in. swing, 16 ft. Bed Engine Lathe. New.
2 19 in. " 8 ft. " " "
2 18 in. " 8 ft. " " "
1 18 in. " 8 ft. " " Tilting carriage
1 18 in. " 11 ft. " " "
1 12 in. " 4 ft. " " New.
2 11 in. " 5 ft. " " "
1 15 in. " 9 ft. Hand Lathe. New.
3 12 in. " 6 ft. " " "
1 10 in. " 4½ ft. Bed Hand Lathe. New.
1 Boring Lathe, 16 ft. bed, 54 in. swing.
1 Round Arbor Fox Lathe. Fine order.
1 26 in. x 26 in. x 6 ft. Planer. New.
2 26 in. x 6 ft. Iron Planer. 2d-hand.
1 12 in. Heavy Slotter. New.
1 48 in. Swing Radial Drill. New.
2 38 in. Swing Upright Drills. B. G. & S. F. New.
1 26 in. Drill. B.G.&S.F. New.
1 18 in. Bench Drill.
1 2 Spindle Drill. New.
1 4 " " "
1 3 " " Second-Hand.
2 4 " " "
2 Wall Drills, heavy. Second-hand. 60 and 72 in
1 9 in. Shaper. 2d-hand.
7 Lincoln Millers. Pratt & Whitney. 2d-hand.
4 " " Phœnix Iron Works. 2d-hand.
1 Pratt & Whitney Hand Miller.
1 Sellers Milling Machine. 2d-hand.
1 Face Milling Machine. Second-hand.
1 Pond's Double Milling Machine. 2d-hand.
1 No. 2 Screw Machine. New. Turret Head.
1 No. 2 " Wire Feed. New.
1 No. 1 " Pratt & Whitney. 2d-hand.
1 No. 3 " " " "
1 Screw Head Slotter. Second-hand.
3 Second-hand Profiling Machines
3 4½ in Hyde's Patent Centering Machines. New.
1 Emery Grinder, 2d-hand, for 10 in. Wheels.
1 Pipe Cutting Machine. Second Hand. 2 in.
1 1 in. Wood & Light Bolt Cutter. New.
1 Bolt Pointing Machine. Second-hand.
1 Double Nut Tapper. New Horizontal.
1 Horizontal Boring Mill, 54 in. Swing.
1 Horizontal Boring Machine, 10 in. Swing. 2d-hand.
1 Betts, No. 2, Power Punch. New.
4 Double-Acting Presses, No. 3, nearly new.
4 Single-Acting Presses, for power, "
100 Foot Presses, nearly new.
1 Medium Power Punching Press. Second hand.
2 Small " " Presses. "
1 Foot Punch, with bench. New.
1 Lot Pistol Machinery. Second-hand.
3 Grind Stones and Frames.
1 Steam Hammer. Cylinder 6½x18. 2d-hand.
Lot of Forges 1 Band Saw, 1 Slat Tenoner, 1 Railway Saw Bench, 1 Foot-power Circular Saw, Cold Rolled Shafting, Pulleys, Hangers, Couplings, &c., always in store.

The George Place Machinery Company,

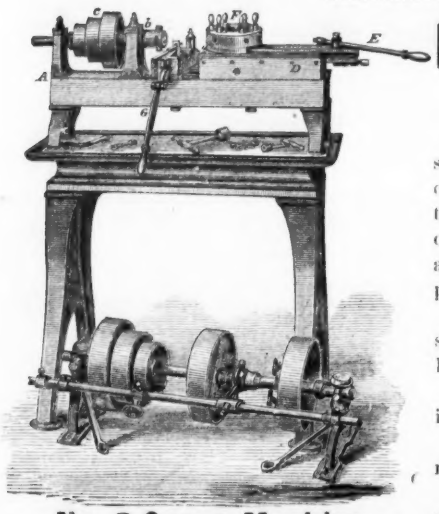
121 Chambers and 103 Reade Sts., New York.

BROWN & SHARPE MFG. CO.

PROVIDENCE, R. I.

MANUFACTURERS OF

Machinery and Tools.



No. 3 Screw Machine.

This machine is designed for making such screws as are used by manufacturers of Sewing Machines, and Fire Arms and the smaller kinds of screws used by machinists. It can be used also for tapping and facing small nuts, making washers, pins, etc.

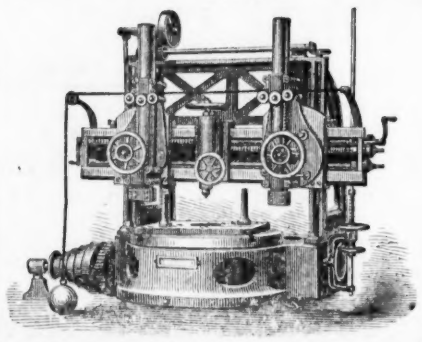
Size of hole through Spindle, 5/8 inch; size of hole in revolving head, 11-16 inch; length that can be milled, 3 1/2 inches.

Friction pulleys on counter-shaft are 10 inches diameter and 3 1/4 inches wide.

Counter-shaft should run 270 turns per minute.

Weight of machine prepared for shipment about 750 lbs.

BORING AND TURNING MILLS.



5, 6, 7, 8, 10, 12, 14 and 16 Feet Swing.

NEW PATTERNS.

Read the following Report of the performance of our Mill.

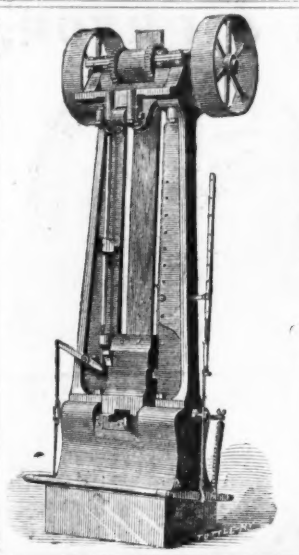
Salem, Col. Co., Ohio, Nov. 27, 1880.

We have just finished another pulley, 12'x27" face, weight 8860 lbs. Yesterday morning at 9 o'clock the rough casting lay on the floor by the mill and we commenced putting on the machine; got a cut started at 10.45 a.m.; finished the rim complete by 9.30 p.m., and got started on facing and boring the hub by 10 p. m.; started again at 7 a.m. this morning, and the pulley off at 11 a.m., 17 hours work all told, including handling on and off. The casting was not a very true one and we chose to take three cuts over the face. Hub was 18" deep, with straight core, bored to gauge and chamber on the machine. Hub faced on one side. If you hear of better time let us know—only 10¼ hours on the rim of pulley. Truly yours,

JOEL SHARP, PREST. BUCKEYE ENGINE CO.

NILES TOOL WORKS, HAMILTON, OHIO.

Eastern Warerooms, 22 S. Sixth St., Philadelphia, Pa.



THE PRATT & WHITNEY CO.

HARTFORD, CONN., U. S. A.

Manufacturers of

MACHINISTS' TOOLS

Gun, and Sewing Machine Machinery.

DROP, & TILT HAMMERS,

POWER, HAND AND FOOT

PUNCHING PRESSES,

Broaching and Drawing Presses,

DIE SINKING MACHINES,

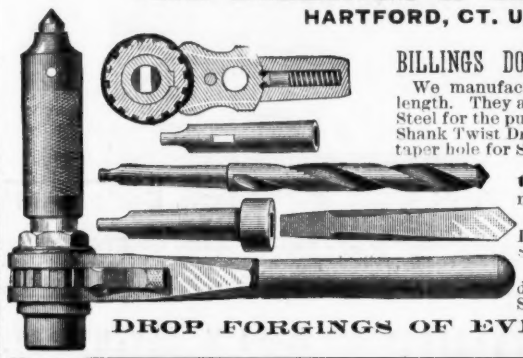
Pillar Shapers and Power Shears.

SEND FOR ILLUSTRATED CATALOGUE AND PRICE LISTS.

THE BILLINGS & SPENCER CO.,

HARTFORD, CT. U. S. A.

MANUFACTURERS OF



BILLINGS DOUBLE ACTING RATCHET DRILLS,

We manufacture two sizes, 10¾, and 13¾ inches in length. They are Drop-forged of the best Bar Iron and Steel for the purpose, and are made to use Morse Taper Shank Twist Drills, also provided with socket with square taper hole for Square Shank Drill.

This Drill can be changed from **Right to Left Hand Drilling** by simply moving the Pawl to right or left.

Price for 10¾" with Socket, to Handle Drills, from ¼" to 29-32" inclusive, and Socket, for Square Shank Drills, $14.00.

Price for 13¾ with Two Sockets, to Handle, Drills from ¼" to 1¼" inclusive, and Socket for Square Shank Drills, $18.25.

DROP FORGINGS OF EVERY DESCRIPTION.

GRANT & BOGERT,

FLUSHING, L. I., N. Y.

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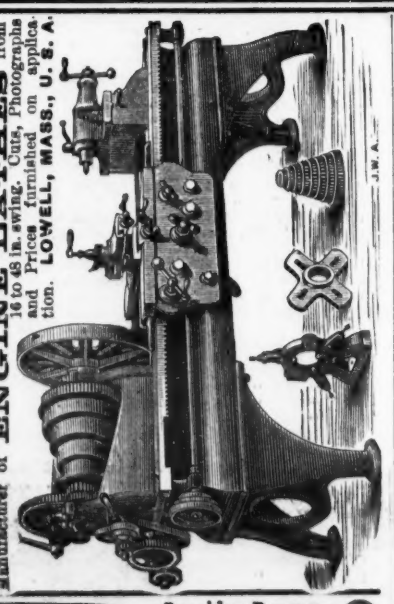

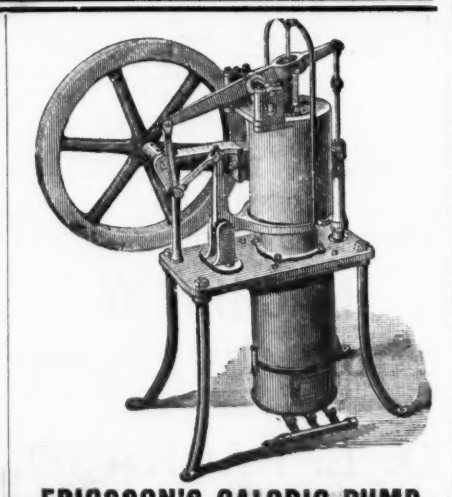

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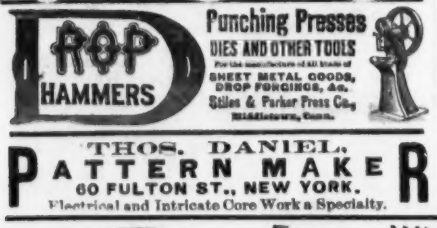

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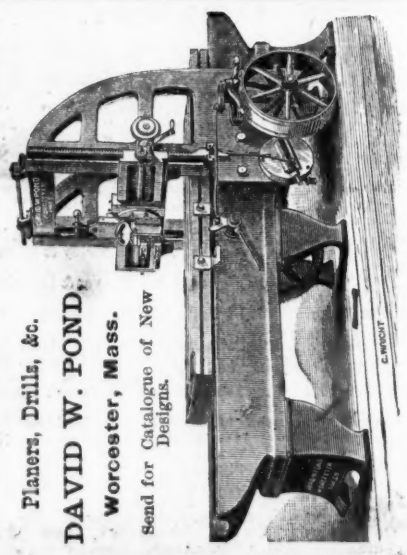

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